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ORIGINAL

FINAL REPORT

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ABSTRACT

This report offers an overview of the work of the Institute for Research on Teaching (IRT), the relationship between research and practice, and what has been learned about improving teacher performance. Some difficulties of teacher improvement are noted, and a description is given of how IRT research findings are communicated to the profession. An 11-section appendix making up the bulk of the report provides project summaries for the following IRT projects completed in September 1986: (1) content determinants; (2) teacher explanation; (3) written literacy forum; (4) science teaching; (5) secondary school science; (6) classroom strategy research; (7) socialization outcomes; (8) conceptual analytic; (9) knowledge use in learning to teach; (10) teachers' conceptual change in practice; and (11) communication, dissemination, and research training. The final pages of this document list IRT publications under a wide variety of headings. (JD)

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FOREWORD

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FOREWORD

In 1976, the need for educational improvement was clear but the most appropriate directions to pursue were not. Reform efforts to make the curriculum teacher proof, led by nationally prominent scientists, had been tried and had failed. Reports by Coleman et al. (1966), Jencks et al. (1972), and others were interpreted to say that neither schools nor teachers made important differences in student achievement. The production function approach to educational improvement (e.g., outcomes follow expenditures) of President Johnson's Great Society was already suspect. It was a time for a fresh approach to educational research. In this climate, the National Institute of Education created the Institute for Research on Teaching (IRT) at Michigan State University.

The thesis upon which IRT work was predicated is deceptively simple. Effective school learning requires good teaching; good teaching requires professionals who exercise judgment in constructing the education of their students. In retrospect, the thesis was revolutionary, representing an ideological premise as well as a scientific claim. Subsequent transformations in thinking about the role of teachers in educational improvement and the role of research on teaching have been remarkable.

In 1976, teachers were either viewed as a weak link in the educational process to be skirted or as technicians to be programmed. In 1986, the leaders of educational reform state

> the key to success lies in creating a profession equal to the task--a profession of well-educated teachers prepared to assume new powers and responsibilities to redesign schools for the future. (Carnegie Forum on Education and the Economy)

In 1986, educational practitioners are looking to research on teaching less for prescriptions and more for principles that will increase their effectiveness as semiautonomous professionals negotiating and mediating among complex and contradictory task demands as they pursue goals of excellence and equity. In the words of teacher Linda Alford,

> Research lets us see how others teach. . . . We can see the effects of their behavior, test our decisions against theirs, match our strategies against theirs and gain insights into ourselves and our teaching. (Alford, 1983)

These views of teaching and research are a far cry from the days when the goal was to create a teacher-proof curriculum and to train teachers as skilled technicians who deliver the prescribed curriculum.

The value of these shifts in thinking about research and educational improvement can be seen in the findings of IRT research. In the pages that follow, IRT work is used to construct a new and more sharply focused image of good teaching, a better understanding of why good teaching is difficult, and some hypotheses about how good teaching can be increased. Following that, each of 10 major IRT research projects are summarized (all projects completed in September 1986). The report closes with a description of IRT's dissemination, research syntheses, and training efforts.

A Conceptual Framework for IRT Research

The framework in Figure 1 represents information that teachers could consider and actions they might take in their teaching. With its causal chain running from left to right and teacher processing of information in the middle, the model portrays good teaching as a tightly coupled rational process. It provides a description of what

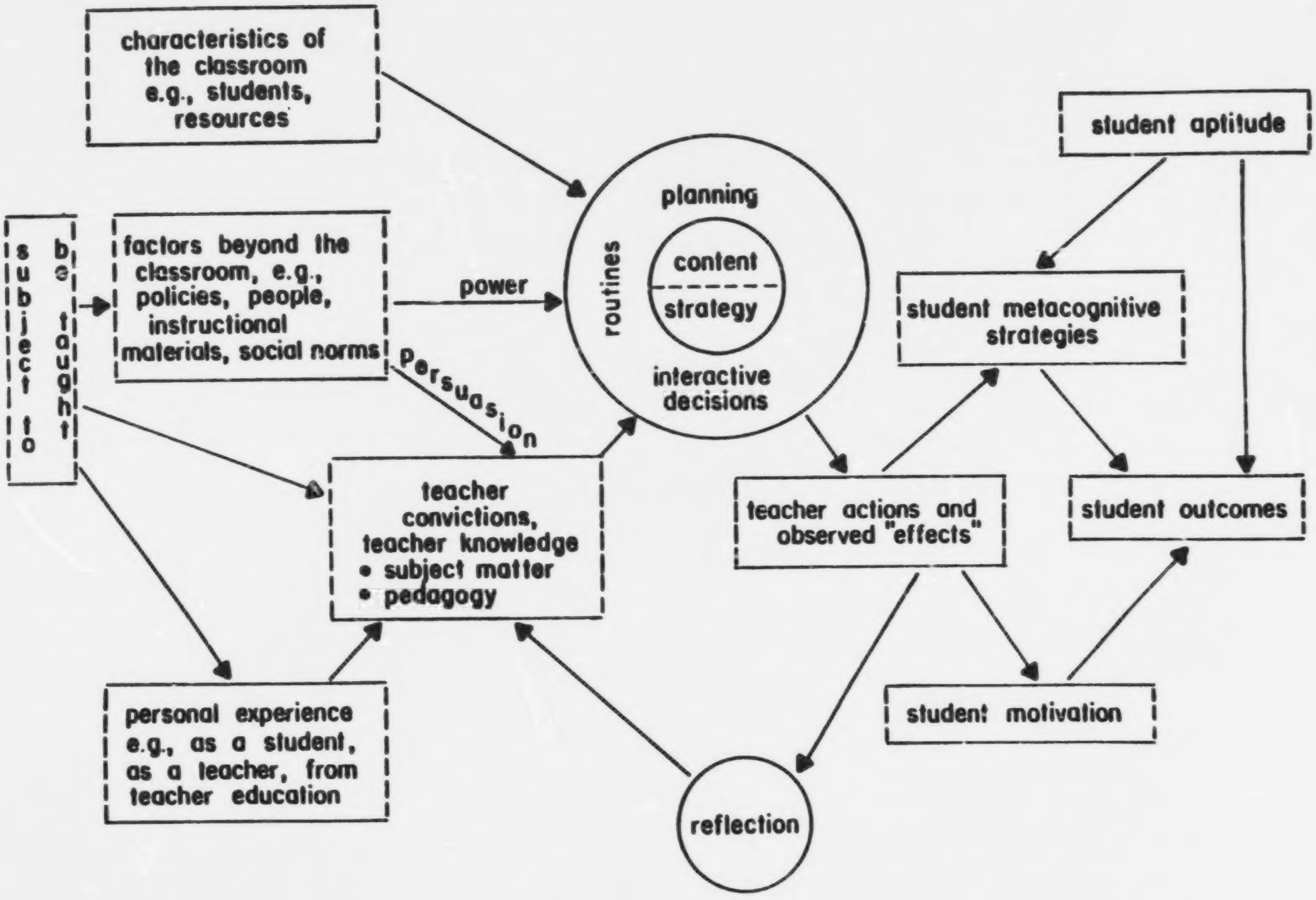
characteristics of the classroom e.g., students, resources
subject to be taught
factors beyond the classroom, e.g., policies, people, instructional materials, social norms
power
persuasion
planning
routines
content
strategy
interactive decisions
teacher convictions, teacher knowledge
• subject matter
• pedagogy
personal experience e.g., as a student, as a teacher, from teacher education
reflection
teacher actions and observed "effects"
student aptitude
student metacognitive strategies
student outcomes
student motivation

Figure I. Model of teacher thoughts and actions.

IRT research has revealed as effective teaching; it does not represent commonly found teaching strategies and practice. The model also makes clear that good teaching is highly complex, containing many points for possible breakdown or error.

IRT research has documented substantial differences among teachers in the extent to which they appear to operate rationally. Teachers simplify their teaching environment in ways that make it manageable for them and then operate rationally within those simplifications. Simon's (1957) concept of bounded rationality is useful in understanding this process. An important IRT accomplishment has been to identify characteristics of teachers' simplified models, determine the extent to which these simplified models are functional, and discover how teachers' models might be made more functional.

There are several features of Figure 1 that highlight how IRT has moved beyond earlier conceptions of research on teacher thinking:

- Both the origins and the outcomes of teacher thinking are represented; early research on teacher thinking was largely descriptive and typically stopped short of estimating effects on students;
- Intermediate student outcomes are included; effective teaching has important indirect effects on student academic learning through improved student motivation and student metacognitive strategies;
- Subject matter is represented as an essential context for understanding teacher thoughts and actions; early research on teacher thinking did not consider how teacher thoughts and actions may vary in important ways from one subject matter area to another;
- Teacher routines are a part of teacher thinking along with planning and interactive decisions; many teacher practices cannot be linked directly to decision making, at least not conscious decision making;

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- Content and strategy are distinguished in representing teacher thinking; understanding good teaching requires attention to both content and pedagogy;

- Direct influences (power) and indirect influences (persuasion) on teachers are distinguished to explain why, for example, some teachers continue to teach in a way consistent with a particular policy, even when that policy has been removed, whereas for other policies teacher compliance is not universal and lasts no longer than the policy;

- Personal experience is represented as an important determinant of how teachers think and what they do, especially a teacher's own experiences as a student;

- Teachers' thoughts and actions are represented as dynamic, making clear that teachers can and do learn from experience.

While individually IRT projects have focused on specific parts of the framework, collectively the projects have complemented each other to address the entire framework. Moving from left to right across the figure, the Content Determinants Project focused primarily on links between factors beyond the classroom, teachers' convictions, and teacher actions. The Conceptual Analytic Project addressed links between personal experience, teachers' convictions, and teachers' thoughts and actions. In an early stage, the Classroom Strategy Research Project focused on connections between student characteristics (i.e., types of "problem" children) and teachers' actions and observed effects. Later, that same project conducted research to show the relationships between teachers' actions and student motivation. The Teachers' Conceptual Change in Practice and the Written Literacy Forum both focused on understanding the role that teacher reflection plays in modifying teachers' convictions and improving teachers' practices. The Teacher Explanation, Science Teaching, and Socialization Outcomes projects all focused on links among

(a) teachers' convictions (especially teacher subject matter knowledge), (b) teacher thinking and subsequent actions, and (c) student outcomes. In particular, the Teacher Explanation Project considered student metacognitive strategies as well as student academic learning.

Tying Together Research and Practice

The IRT is committed to research that holds high promise for improving practice. To ensure that its research and dissemination efforts are directed toward the improvement of practice, the IRT has taken a number of steps: involving teachers in the work, focusing research on enduring problems of practice, directly studying efforts to improve teaching, and maintaining an environment in which researchers have become increasingly sophisticated in their understanding of education.

Teachers as Research Collaborators

Coming from the world of practice, in fact keeping one foot in the world of practice,[1] teacher collaborators have kept our research sensitive to important problems of practice. These teacher collaborators have added credibility to our research and to the ways in which our researchers present it. Through their interaction with teacher collaborators, faculty have asked better and more practice-oriented research questions, used more externally valid research methods, and interpreted their findings more fully. But the benefits derived from teacher collaboration have not been unidirectional. Through the process of collaboration, teachers have come to understand and appreciate better the strengths and limitations of their own practice and to be more receptive to new ideas and more analytic in the applications of those new ideas. Teacher collaboration at the IRT has built a bridge between research and practice.

The IRT was among the very first research organizations to use teacher collaboration, and in the beginning the concept met with greater skepticism than enthusiasm. Now the reverse is true. Thus, while teacher collaboration has become a unique strength of the IRT in ensuring that our research and practice stay connected, each informing the other, knowledge about teacher collaboration itself has also become an important product of IRT work. Researchers throughout the United States and to some extent in other countries are increasingly collaborating with practitioners as they conduct educational research. The effect is stronger connections between research and practice.

Enduring Problems of Practice

Another and closely related way in which the IRT has tied research and practice together is through its focus on enduring problems of practice, problems that are experienced as important by many, if not all, teachers in the United States and that cannot be easily solved. Teacher collaborators have been instrumental in helping to identify the enduring problems of practice that have been translated into several of IRT's projects. For example, teacher collaborators were concerned that a relatively small number of students in any classroom require a disproportionately large share of a teacher's time. Some teachers, however, develop reputations for being unusually effective with these "problem children." These concerns led to IRT's Classroom Strategy Research Project.

Another example is IRT's Socialization Outcomes Project which was originally stimulated by teacher collaborators' concerns for the nonacademic goals of schooling, what they are, how they are promoted, how they can be assessed, and how they may draw attention away from academic goals. Yet another example is the Language Arts Project which began with teacher collaborators' concerns for ways to make more efficient use of extremely limited classroom time by integrating the teaching of language arts with the teaching of other subjects. Other enduring problems of practice that have served to motivate IRT research include:

- How to deal with the tensions between demanding excellence and providing equality of educational opportunity;
- How to satisfy students in the short run by keeping them interested, happy, and enrolled while satisfying society in the long run by teaching students important but sometimes difficult content;
- How to meet the individual needs of students while having the responsibility to teach all subjects to all students (or in the case of high school teachers, having responsibility for approximately 180 different students);
- Balancing the desire to pursue student achievement through creating an orderly and well-managed classroom with the desire to pursue a well-managed classroom through instruction on content for which students are motivated and from which they learn;
- Determining the optimum balance between teacher autonomy and external control, especially when recognizing the large and diverse properties of the nation's 2.4 million teachers.

Teacher Change

Conducting research and scholarship directly on problems of teacher change is a third way in which IRT has tied together research and practice. IRT's Teachers' Conceptual Change in Practice Project and its Written Literacy Forum both focused on how teachers can be assisted in reflecting upon their own practice and, drawing from research knowledge, redesign their practice in ways that are both more effective and more professionally satisfying. Other IRT projects moved from early descriptive work to intervention studies (e.g., Classroom Strategy Research, Science Teaching, Teacher Explanation). From this work, a great deal has been learned about how teaching practices can be changed in desired directions and about the subsequent effects of these changes on student achievement.

Often, teachers are eager to hear prescriptions for how to improve their practice. To some extent, research on teaching has been able to identify elements of a technology for teaching, specific patterns which strengthen teacher effectiveness. More often, IRT research has identified principles of good practice, approaches to teaching that require teacher judgment in their implementation. Increasingly, teachers have come to view research on teaching as an important resource for providing new perspectives on their own teaching. Familiarity with what has been learned from research on teaching, coupled with assistance in reflecting on their own practices, has been especially effective in getting teachers to produce sustained improvements in their teaching practices.

Becoming Researchers of Teaching

Yet a fourth way IRT has tied together research and practice is through an evolution in the identity and sophistication of its research staff. Over its 10-year history, IRT has systematically recruited persons from a variety of disciplines to carry out its research agenda. These individuals have pursued research on teaching from their own particular disciplinary perspectives. While each IRT project has tended to maintain a distinct disciplinary perspective over time, members of the research staff have gradually shifted from identifying exclusively with their discipline and doing research in education to identifying with education and doing research on teaching. A greater sensitivity to educational issues and a greater commitment to research that holds potential for improving education has been the result.

What We Have Learned

IRT has supported many projects, each with its own unique research questions and research methods. By having a coherent program of research which transcends the individual projects, however, it is possible to look across projects and reach new understandings of teaching and learning that would not otherwise have been possible. A number of these macro-level findings are summarized below; the documentation for them lies in the work of the separate projects described in later sections of this report.[2]

Orientations to Teaching

In its focus on teacher decision making, IRT research has sought to discover the origins of teachers' actions as well as their consequences. It would be misleading to cast the results of these inquiries as pointing to teachers as totally rational, setting crisp instructional objectives, planning activities against those objectives, monitoring student outcomes, and making adjustments in their instruction when adjustment seems indicated. But it is true that teachers' classroom practices are influenced in important ways by the goals teachers hold for schooling and by the responsibilities teachers are willing to accept.

Teachers differ in the goals they hold for their instruction. These differences in goals result in important differences in teacher practices and in what is accomplished with students. One of the fundamental challenges of teaching is that there are more important things to be accomplished than can be done within the time and energy available. To cope, teachers simplify their work environment through focusing their efforts. A major IRT finding has been, however, that teachers need not always give up one goal to obtain energy and time for another. For example, in studies of general mathematics we found that by putting greater emphasis on students' understanding of concepts, teachers were also able to better promote students' mastery of computational skills.[3] In another study we found that teachers who set both academic achievement and socialization skills as goals for their instruction were more effective in the attainment of both than were teachers who emphasized socialization skills over all else.[4] In yet another study, we found that language arts teachers who attempted to integrate the teaching of language arts with the teaching of another subject were successful in teaching both the subject and the language arts skills (unfortunately such integration was a relatively rare occurrence).[5]

There can also be negative consequences when teachers do not have focused goals. For example, IRT research has shown that teachers are much more easily persuaded to add new topics to their instruction than they are to delete topics that they have been teaching.[6] The net result is a thinning out of the curriculum with large numbers of topics being taught for very brief periods of time (essentially just mentioning topics, with little hope for student mastery).

IRT research has also found evidence of teachers holding goals that would be questioned by many if they were known (Sedlak, Wheeler, Pullin, & Cusick, 1986). For some teachers, the goal becomes survival, passing time in a way that is satisfactory to them and their students. Standards are sacrificed in the pursuit of a comfortable environment. When teachers and students strike such a bargain, the effect is a compromised curriculum.

Whereas differences among teachers in the goals they hold for their instruction help explain differences in teachers' effectiveness, a caveat is necessary. By no means does IRT research find a one-to-one relationship between teachers' goals and student learning. Regardless of the goals teachers hold, their effectiveness in attaining those goals with their students is a function of many factors that further define teacher effectiveness (e.g., skill in managing the classroom in a way that creates an orderly, businesslike learning environment; the ability to motivate students for instructional tasks and their outcomes; clarity of explanations; skill in conducting recitations; subject matter knowledge).[7]

Teachers who accept responsibility for student outcomes are more effective than teachers who see students as solely responsible for what they learn and how they behave. Just as early research had shown the importance of believing students are capable of learning from instruction, recent IRT research has shown it useful for a teacher to believe that, when the teaching/learning process breaks down, *both* the teacher and the student must assess the situation and make corrective adjustments. For example, in dealing with problem children, teachers identified as most effective with a particular type of problem saw the problem as one they must help to solve, not simply something to be endured, but something to be corrected. Moreover, the most effective teachers with a particular type of student problem had the confidence to see the problem as less serious than an outside observer might.[8] As another example, low aptitude students in science achieve much better if they are in a classroom where their teacher accepts responsibility for getting all students to learn science. Many science teachers, however, attribute student success or failure solely to the students.[9]

The fact that teachers are selective in the responsibility that they accept for themselves is not surprising, given the variety of individual differences with which they are asked to cope effectively. This is not necessarily a negative finding, however. Teachers are willing to take on increasing responsibilities as they are given more effective strategies for coping with their classroom situations.

Characteristics of Effective Instruction

Process-product research on teaching has provided numerous insights into specific teaching behaviors which, when employed, result in better managed classrooms and greater student learning. IRT research, with its focus on teacher thinking and decision making, has added to what is known about specific teaching behaviors and their effects (much of this new knowledge is described in the following sections of this report). It has also been possible to extrapolate general principles of effective instruction that help to make sense of and coordinate the array of specific effective behaviors and "package" them in ways that make them more accessible to practicing teachers. In other words, IRT research has been useful in moving from the level of teaching skills to the level of coherent teaching strategies.

Teachers who are careful to communicate to their students what is expected and why promote greater student learning.[10] Just as teachers behave in ways that are generally consistent with the goals and the responsibilities they accept, so do students. Unfortunately, school is not always viewed by students as a place for learning important academic knowledge and skills. Rather, school is seen by many as a requirement and a place to acquire a certificate.

Some teachers are especially effective at helping students understand what is to be learned and why learning might be useful to them. These teachers begin their lessons by explicit statements of what is to be learned and how what is to be learned relates to what has been learned and what will be learned in the future. These teachers motivate students to learn by providing explanations that go beyond the immediate school context. Throughout the lesson, they monitor student task orientation to ensure that all students understand the reasons behind assignments as well as how to complete the assignments. The value of teachers' making sure that students understand what is expected and why appears to be equally useful in fostering personal and social responsibility in students as it is in promoting academic achievement.

Teachers who provide strategies to students for monitoring and improving their own learning behaviors and who give students structured opportunities for independent learning activities are more effective than those who do not.[11] Making sure that students understand what is to be learned and why can be viewed as one step toward preparing students to share responsibility with the teacher for their own learning. An important complementary step is to provide students with skills and procedures that give them the capacity to learn independently. Teachers who make the teaching of metacognitive strategies an explicit part of their instruction and who model those strategies themselves have positive effects on student achievement. But helping students acquire metacognitive strategies is not by itself sufficient. Teachers must also provide students with opportunities to practice these strategies, to work independently and in groups outside the direct and close supervision of their teacher. There is a tension, however, between teachers' giving students too much and too little latitude over what they are to do and how they are to do it in the classroom. Too much latitude fosters chaos whereas too little latitude places limits on what students accomplish.

Effective teachers know the subject matter they intend their students to learn, but they also know the misconceptions their students bring to the classroom that interfere with student learning.[12] That teachers understand the content they are expected to teach cannot be taken for granted. Even at the elementary school level, some teachers have a much better grasp of the concepts, skills, and applications their students are to learn than do other teachers. Even greater differences exist among teachers in their ability to enrich instruction by drawing upon subject matter knowledge that goes beyond the immediate goals for student learning. IRT research has begun to document the ways in which command of subject matter influences teachers' expectations for what students can and should learn as well as the effectiveness of teachers' pedagogical strategies. In teacher preparation, concern for subject matter knowledge is a "no man's land." Teacher education courses limit themselves to pedagogy while the rest of the university teaches advanced knowledge but ignores the subject matter teachers will be expected to teach.

But good teachers need more than a thorough command of the subject they will teach. They must also know the common misunderstandings that their students will bring to the classroom. For example, most elementary students believe that plants get food from the soil--an idea in direct conflict with the concept of photosynthesis. Instruction proceeds much more effectively if teachers address such student misconceptions directly in the process of teaching new material. To teach the concept of photosynthesis without mentioning specifically that plants do not get food from the soil leaves most students with their entering misconceptions intact.

Close use of published instructional materials more often facilitates the quality of instruction than impedes it.[13] An unfortunate backlash to attempts of the late 1950s and early 1960s to create teacher-proof materials has been for teacher educators and teachers to believe that good teachers are not textbook followers. Teachers are led to believe that they should break new ground in their instruction, either developing their own instructional materials or expecting students to learn without the support of prepared materials. But teachers are not trained to develop their own materials, and the constraints of the typical teaching assignment do not provide the time needed to develop good instructional materials anyway.

Clearly, published instructional materials have their faults. The literary and pedagogical value of passages in reading texts on which students spend large quantities of time can and have been questioned. The tendency of mathematics texts to cover large numbers of topics only briefly may also be questioned. But the implied assumption that teachers can do better on their own and with scarce resources of time and money is even more questionable. By carefully selecting instructional materials to fit the curriculum and the characteristics of the students to be taught and by making extensive use of those materials, teachers are freed to spend their time and energy in practices that enrich the content through reinterpretation and expansion and to clarify the content through presentation, recitation, discussion, and evaluation.

Is Teaching Math Just Like Teaching Writing?

During the past five years, the IRT has studied the teaching of mathematics, science, and writing in addition to reading which was its earlier focus. The research agenda moved away from questions of classroom management and student discipline, which to some extent can be defined independently of the subject matter being taught, and toward questions of the role of metacognitive strategies in the teaching of reading, how teachers decide what mathematics to teach, how to take account of student misconceptions in the teaching of science, and how might the amount of writing instruction in elementary schools be increased. There was no design on subject matter to ensure that similar research questions would be asked in each of several subject matter areas using common research methodology. Nevertheless, IRT research has begun to create a picture of the ways in which teaching is similar across subject matter areas and the ways in which teaching is unique to a particular subject.

The picture that emerges from this work is one of important differences in the teaching of reading, mathematics, science, and writing. For example, elementary school teachers spend much more time teaching reading than any other subject (from 30 to 45% of their total instructional time).[14] Mathematics is a distant second, but still there is a regularly scheduled time for mathematics (typically each day for a period ranging from 30 minutes to an hour).[15] In contrast, science is rarely if ever taught in many elementary school classrooms and writing is generally not taught at a regularly scheduled time.[16]

As another example, instructional materials in reading tend to specify both the content and the methods for teaching students to read. Research shows that these materials are followed closely by most teachers. In mathematics, teachers tend to view the text as a resource to be added to or (more often) deleted from as seems appropriate. Math texts are typically silent on how instruction is to proceed, serving primarily as a source of content. In science, teachers tend to follow the text closely, but the texts lack information on how instruction should proceed. Published materials for the teaching of writing are largely unavailable.[17]

As yet a third example, there appear to be important differences in the level of subject matter knowledge that teachers have in different areas. Teachers are most knowledgeable in reading, variable in their knowledge (and interest) in mathematics and writing, and are typically weak in science.[18]

In short, IRT research has begun to reveal important differences in teaching different subject matters, especially in elementary schools. The requirements levied on teachers and the degree of autonomy they are given appear to vary in important ways between reading, mathematics, science, and writing.

Good Teaching: Adding Pieces to the Solution

Research on teacher thinking and decision making at the IRT (and increasingly elsewhere) has added important pieces to our understanding of the principles and practices which collectively constitute effective instruction. By drawing from the preceding sections and filling in gaps with information contained in subsequent sections of this report, an image emerges of a thoughtful practitioner operating purposefully and with considerable autonomy.

Effective teachers are clear about what is to be accomplished by instruction, both in designing the instruction and in communicating the purposes of that instruction to students. They make certain that students understand and are satisfied by the reasons why they should learn what they are asked to learn.

Effective instruction provides students with metacognitive strategies that help them acquire a degree of independence in their learning. It also includes structured opportunities for students to exercise and practice independent learning.

Effective teachers create learning situations in which students are expected to organize information in new ways and formulate problems for themselves, not just learn facts and solve problems that have been given to them. These learning situations include creative writing in language arts, problem formulation in mathematics, and independent projects in science, social studies, and literature. Such teaching is intrinsically more demanding for both teacher and students than traditional "information telling and drill and practice" teaching.

Students' understanding of what they are accomplishing, why, and the quality of their subsequent work is continuously monitored by effective teachers. Detailed and timely feedback is provided to all students (but not necessarily in the same ways for all students).

Instruction is integrated across common boundaries so that, for example, students learn to read through writing and students practice their reading skills on text which is worthwhile in its own right (e.g., literature, social studies, geography). When learning serves students' purposes beyond pleasing the teacher, that learning tends to be remembered and of continuing use in future learning.

Effective teachers are thoughtful about their practice; they take time for reflection and self-evaluation. These teachers monitor the content of their instruction to make sure that worthwhile content is being taught to all students. They accept personal responsibility for student learning and student behavior.

The Difficulties of Teacher Improvement

While IRT research has documented all of the above as important principles in describing effective instruction, that same research also makes clear that few teachers follow all of these practices all of the time. Yet, IRT research shows that most teachers believe that they are doing an effective job. Certainly there are many outstanding teachers and many more teachers who do some things particularly well. But general satisfaction among teachers suggests that, as a group, they may not see a need for making the substantial investments required to change their teaching practices in the directions outlined above.

There is little evidence from IRT research that teachers are actively resistant to change. When interventions are designed to change teachers' practices in particular ways, they are usually successful, at least with many teachers in the short run. Still, even after teachers have acquired the knowledge and skills necessary for changes in their practices and have seen positive results with their students, all too often they revert back to their old habits.

Part of the explanation for the difficulties in stimulating long-term change in teaching practices may stem from what appears to be a trial and error approach to "see what works for me" that may actually be promoted in teacher education.[19] Another part of the explanation may be that teachers teach in isolation, away from the view and possible critical commentary of their peers and other adults. They also must cope with a full agenda that typically precludes time for serious reflection.

A third part of the explanation is that, as research identifies more and more elements of effective teaching practice, there are many recommendations for additional things for teachers to do and few, if any, recommendations for what should be given up. The picture of good teaching that is emerging is one of hard work, hard thinking, tough choices, and objective evaluations. The energy required to teach this way may be underestimated by research that typically considers only one segment of a teacher's professional life at a time. Research tends to look at teaching in small segments: lesson by lesson, day by day, subject by subject, year by year, and tends not to consider what is required all day, every day, year after year. More needs to be known about the costs that teachers experience in adopting new approaches to their teaching and how those costs might be ameliorated.

Communicating the Findings of IRT Research

It is not enough to conduct research, no matter how good; the results of the research must be made available to other researchers, to teachers and educational administrators, to teacher educators, and to policymakers. Two of the three major tasks specified by the United States Department of Education in their call for an IRT concerned dissemination: (a) to communicate with the field and (b) to refine conceptual frameworks and synthesize research. The IRT has taken these charges seriously. Dissemination activity over the past five years represents a 73% increase over the first five years. IRT researchers and teacher collaborators have reported IRT work directly and personally to approximately 100,000 persons, nearly half of whom were teachers and administrators, and another 20% of whom were teacher educators. IRT research has resulted in over 250 publications in journals and books. There are nearly 300 monographs in IRT's research series and occasional papers series (approximately 40% of which were subsequently published in refereed journals or books). An IRT quarterly newsletter is received by over 10,000 educational practitioners and researchers in all 50 states and 20 foreign countries.

Research syntheses are an especially important part of the IRT corpus. IRT senior researchers authored six of the chapters in the most recent edition of the prestigious Handbook of Research on Teaching (Brophy & Good, 1986; Clark & Peterson, 1986; Erickson, 1986; Feiman-Nemser & Floden, 1986; Good & Brophy, 1986; Lanier with Little, 1986). A synthesis of research on teacher praise by Co-director Jere Brophy (1981) received AERA's Palmer O. Johnson Award for the best review article published in an AERA-sponsored journal.

Another way in which the IRT promotes synthesis and critique of research information is by coordinating the Invisible College for

Research on Teaching, an informal network of 150 national and international scholars. Begun in 1976, the Invisible College meets annually to bring together leaders in the field as well as junior researchers to share state-of-the-art knowledge and argue research priorities and strategies. These are but a few of the most visible of our research synthesis efforts. IRT senior researchers are continually refining conceptual frameworks for research on teaching to make clear how IRT work and work done elsewhere fit together to make coherent statements about teaching and how it might be improved.

The Set of Projects

During the 1981 through 1986 contract period with OERI, 16 projects were initiated and completed. Project summaries for the 10 projects just completed form the bulk of what follows in this final report. The other 6 projects were completed earlier in the contract period and their summaries can be found in earlier progress reports.

Without OERI's institutional funding of the IRT, these 16 research projects could not have been undertaken. But OERI's institutional support has also served as leverage to obtain additional investments in research on teaching. Through cost sharing, Michigan State University augmented the level of effort possible from OERI funds by an additional 40%. OERI institutional support for an IRT created leverage of another type as well. During the past five years the IRT initiated 6 separately funded projects in addition to the 16 mentioned above, 4 of which are continuing beyond the end of the current five-year OERI contract and all of which addressed the research agenda of the IRT.

The next 10 sections of this report provide project summaries for the IRT projects completed in September 1986. Separately they describe teaching practices and how they might be improved in reading, mathematics, science, and writing. They consider how students can be taught to be more productive and more highly motivated and how teachers can learn to be more effective. Collectively they provide an understanding of teaching as a rational, highly professional endeavor. They point to new directions for educational improvement and lay the groundwork for a new research agenda.

Footnotes

[1] Teacher collaborators continue half-time teaching assignments while working at the IRT.

[2] An especially useful activity for facilitating cross-project syntheses has been having each project compile a list of its most significant findings/conclusions. This compilation can be found in the appendix.

[3] See especially the General Mathematics Project last described the progress report for the period ending September 30, 1985.

[4] See especially the Affective Outcomes Project last described in the progress report for the period ending September 30, 1981.

[5] See especially the Language Arts Project last described in the progress report for the period ending March 31, 1982.

[6] See especially the Content Determinants Project.

[7] Virtually all of IRT's projects lend support for this statement.

[8] See especially the Classroom Strategy Research Project.

[9] See especially the Secondary School Science Project.

[10] See especially the Teacher Explanation Project and Socialization Outcomes Project.

[11] See especially the Teacher Explanation Project and Teachers' Conceptual Change in Practice Project.

[12] See especially the Written Literacy Forum, Science Teaching Project, Conceptual Analytic Project, and Knowledge Use in Learning to Teach Project.

[13] See especially the Content Determinants Project, Written Literacy Forum, and Knowledge Use in Learning to Teach Project.

[14] See especially the Language Arts Project last described in the progress report for the period ending March 31, 1982.

[15] See especially the Content Determinants Project.

[16] See especially the Written Literacy Forum and Science Teaching Project.

[17] See especially the Content Determinants Project, Teacher Explanation Project, and Written Literacy Forum.

[18] See especially the Content Determinants Project, Teacher Explanation Project, and Written Literacy Forum.

[19] See especially the Knowledge Use in Learning to Teach Project.

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Appendix

Institute for Research on Teaching Findings

Of all of the research centers funded by NIE, the Institute for Research on Teaching is the only one established to study "the whole teacher"--the teacher's roles vis-a-vis the society, the school district, and the students; the professional planning, thinking, and decision making involved in playing those roles; and the strategies and supporting rationales for setting and pursuing goals suited to the needs of students and feasible within the constraints under which the teacher must work. Teachers receive input from various experts and specialists, mandates from policymakers and administrators, and training via preservice and inservice education, but ultimately it is up to them as individual professionals to "put it all together" and develop workable methods for discharging their responsibilities under conditions of limited time and resources and multiple and competing goals.

The thrust of all lines of inquiry at the IRT is (a) to analyze teacher thinking and decision making and (b) to investigate what excellent teaching requires by way of understanding students, subject matter, and the settings in which teaching takes place. This commitment to educational improvement is ensured by insisting that all IRT research projects address one or more enduring problems of practice, problems that cannot be easily solved and that are experienced as important by many if not all teachers in the United States.

In its relatively short nine-year history, the Institute for Research on Teaching has provided the leadership in defining this new and increasingly productive area of inquiry--research on teacher decision making. Much has been learned but much remains to be done. For example, from the following findings it is becoming clear that teachers differ in surprising and substantial ways as to the purposes they hold for schooling and the responsibilities they are willing to accept for themselves. There is an emerging body of evidence to document how these differences in teachers' convictions affect their behaviors and, through those behaviors, the nature and quality of instruction provided to students. More needs to be learned about the factors that shape and challenge these teachers' beliefs and about their relationships to instructional practices and their effects.

The IRT is generally looked to as a model for how practitioner collaboration can be productively accomplished in a research arena. The Institute has given stature to teachers in research on teaching, presenting teachers as policymakers in their own right. This has been accomplished through (a) assembling outstanding researchers representing a variety of disciplinary perspectives in conducting an applied program of research and (b) pioneering the concept of teacher collaboration. Concentrating on research in natural classroom situations, the IRT is developing information on how teachers can respond effectively to the challenges they face. Emphasis on practical problems facing teachers and on how these problems can be addressed under actual classroom conditions makes IRT research of wide interest and use to the educational community, most especially to teachers and teacher educators.

Below is a listing of some important findings from selected past and present IRT projects and related work by IRT investigators (some projects are scheduled for data analysis and reporting during the coming year, so that statements about findings would be premature at this time). The presentation is limited to brief statements of general findings: documentation is provided in existing or forthcoming IRT research reports. The IRT is in the preliminary stage of a major review and synthesis of its past work. What follows will be elaborated considerably as this review and synthesis process continues.

Content Determinants

The Content Determinants project seeks to clarify the decision-making process whereby elementary school teachers determine the content of mathematics instruction for their students. Content decisions include how much time to allocate to the subject matter area over the course of the school year, what topics to teach to which students, when and in what order, and to what standards of achievement. Teachers are viewed as political brokers in the process of content determination. They have some discretion to follow their own convictions, but are subject to pressures from state and district policies, publishers' texts and materials, testing programs, and input from administrators, other teachers, parents, and students.

Findings

1. When left to make their own content decisions, most teachers do not view the math text as prescriptive. Instead, they view it as a resource to be drawn from and augmented as seems best. Thus, teachers differ in important ways in their use of mathematics instructional materials.

2. Most teachers would readily make changes in the content of their instruction when such changes are consistent with their repertoires. A great many teachers would

even make changes that are inconsistent with their repertoires, provided that pressures for such changes came from persons perceived as having legal or expert authority and that the teachers received ample training and other help in making the changes.

3. Teachers are typically more resistant to dropping topics or time allocation to mathematics than they are to adding topics or time allocation to mathematics (even though any such additions in topics or time imply cutting back on other topics or time devoted to something else).

4. A relatively weak set of policies can have dramatic effects on teachers' content decisions. For example, a management by objectives program in which parts of the text are cross-referenced to the objectives can serve as a powerful template for leading teachers to focus on a specific subset of the text's content (and to try to teach this content to an externally specified standard of achievement). No rewards or sanctions need to be attached to the use of the program.

5. There is great variation among states and among districts within states in approaches to curricular policy formulation. Generally, there are relatively weak and uncoordinated policies concerning what to teach, to whom, for how long, and to what standards of achievement. Nevertheless, state level policy formulation tends to be copied at the district level, and both state and district policies are changing toward increased control of teachers.

6. State textbook adoptions in mathematics have little direct effect on teachers' content decisions, because several texts are adopted and because the states are silent about how texts are to be used. Similarly, the local school hierarchy rarely provides teachers with guidance on how to use texts, even when a single text has been adopted.

7. Textbooks may influence what topics are taught, especially for new teachers or in the first year of a new adoption. Topics included in the book are more likely to be taught than other topics. Also, the nature of the text may have indirect effects on teachers' decisions about standards of achievement to which students should be held. A book that provides many pages of exercises on a particular topic may induce high standards, whereas a text that covers many topics briefly may suggest "teaching for exposure" rather than "teaching for mastery."

8. There is profound variation across teachers and across time for the same teacher on each of the six content decisions investigated, even in districts with strong content policies. For example, teachers' allocation of instructional time to math varies substantially within districts, schools, and grades. The number of days on which no math is taught at all is as high as 15 to 20% in some classrooms, but is close to 0 in others.

9. The content of elementary school mathematics tends to be narrow, with a great deal of emphasis on drill and practice of a limited range of computational skills but little emphasis on conceptual understanding and applications. Relatively little time is allocated to math compared to reading or language arts.

10. Time allocation to mathematics receives little attention in state/district/school policy formulation, despite the emphasis on time allocation in the literature. When time guidelines do exist, however, teachers perceive them as having strong effects on their practice.

11. Homogeneous grouping for mathematics tends to result in restriction of content taught to individual students; management by objectives approaches restrict content even more. Students in low groups get less time for mathematics instruction, a lower conceptual level of the content taught, and a more restricted range of topics. Students in high groups nevertheless do not often get advanced content. Such grouping is less common in math than in reading, and it appears to be decreasing in frequency across recent years.

12. The degree of overlap in the content included in four of the leading textbook series is considerably below what is commonly assumed. About half of a given textbook is likely to be devoted to a set of core topics that receives coverage in all or at least most of the books, but the other half of a given book is likely to be devoted to content that is unique to the book or is covered in only a few other texts. The core topics tend to be covered systematically, but the remaining topics tend to be merely "touched on."

13. There is considerable variation in the overlap between the content emphasized in a particular text and the content included on a particular standardized achievement test. Some standardized tests are relatively satisfactory measures of achievement for students taught with a particular mathematics text, but other standardized tests are not. Where there is poor overlap between the content included in the text and the content on the test, the test results may seriously

underestimate the students' mastery of the content that was actually taught to them.

Teacher Explanation

The Teacher Explanation project is studying the relationship between the explicitness of teachers' explanations during reading instruction to students in low reading groups and the levels of reading achievement and awareness of use of reading strategies shown by these students. It follows up on earlier work on teachers' conceptions of reading.

Findings

1. Elementary teachers hold varying conceptions of the reading process but nevertheless tend to teach reading similarly because they tend to use the materials and follow the instructions provided with the basal reading programs adopted in their schools. Despite rhetoric to the contrary, basal programs tend to be similar to one another, and in contrast to mathematics textbook series, basal reading series tend to prescribe how to teach in addition to what to teach.

2. Unfortunately, little if any instruction in strategies for reading with comprehension occurs, even in the intermediate grades. Students are often asked comprehension questions following their reading or given assignments intended to provide practice in reading with comprehension, but they are rarely given explicit instruction in comprehension strategies.

3. Teachers can be taught to provide such instruction through modeling and explicit explanation. The modeling involves "thinking aloud" to make visible to the students the covert processes that one uses when reading for comprehension; and the explicit explanations include specification of the nature and purpose of the reading comprehension strategy being taught, when it should be used, and why it is needed.

4. This notion of explicit instruction is new and difficult to assimilate for most teachers. Consequently, intensive instruction that includes a great deal of modeling is needed to get teachers started successfully, and several months of follow up that includes

frequent observation in the teacher's classroom and provision of feedback and coaching are needed to perfect these skills.

5. When teachers do begin to use explicit instruction in reading comprehension with their low group students, these students become much more aware of what is being taught, when to use it, and how to use it. Their scores on standardized reading comprehension also tend to increase, although these increases are sometimes marginal because standardized achievement tests are confined to questions about brief paragraphs and thus do not measure the ability to comprehend extended discourse that is the focus of the comprehension strategies taught through explicit instruction.

6. Instruction in reading comprehension strategies is likely to be more effective when followed by immediate application opportunities and tied in with whatever reading the students do both in and out of school than when taught as isolated skills and referred to only during reading instruction.

Outcomes in Reading

This project has involved studying the processes used by reading specialists and ordinary teachers for identifying and diagnosing deficiencies in student reading performance, the reliability of these diagnoses, and the possibilities for training teachers to be more reliable and to make good use of the diagnostic information.

Findings

1. Neither reading specialists nor ordinary teachers are reliable when compared with one another or even stable when compared with themselves across time in identifying the strengths and weaknesses in a student's oral reading performance, in making diagnoses that link performance deficiencies to causes, or in prescribing remedial treatments.

2. Furthermore, reading specialists tend to prescribe the same brief list of remedial activities for most of the cases they diagnose, more or less regardless of the specifics of the diagnosis. Different specialists prescribe different combinations of remedial experiences, but a given specialist tends to prescribe the

same combination for most if not all of the cases that he or she diagnoses.

3. In combination, the above findings suggest that the diagnoses made by reading specialists trained in traditional fashion are not reliable enough to serve as guidelines for investigating diagnosis-prescription linkages, and that in any case, differences in stated diagnoses do not usually lead to corresponding differences in prescribed remedial treatments.

4. However, prior research and development work on this project has produced computer programs capable of identifying the areas of agreement among specialists attempting to diagnose the same case. In contrast to the human diagnosticians, the diagnoses made by this program are stable over time and reliable across comparable cases.

5. Human diagnosticians (reading specialists and ordinary teachers) taught to follow the procedures used by the computerized diagnostic program can learn to achieve similar stability and reliability in their diagnoses, especially when they use decision aids designed to ensure that they follow the procedures systematically.

6. This training program in reading diagnosis is now available in computerized instruction form and is being used in university courses for reading specialists.

Written Literacy Forum

The Written Literacy Forum is a collaborative effort in which IRT faculty and staff work with local teachers to review literature, conduct experiments, and develop information about effective writing instruction.

Findings

1. Whereas occasions for writing occur throughout the school day, not just during language arts time allocated for formal instruction in writing, little or no technical support is typically given to students during their actual writing time. Students do not spend much time writing first drafts, they rarely revise anything they have written, and most school writing never leaves the classroom to be read by someone other than the teacher.

2. Teachers generally have been left on their own with respect to writing instruction. In contrast to the situation in other subject matter areas, teachers tend to plan and teach writing with neither the limitations nor the guidance of district policies, published materials, or professional training in theories of the writing process. Most teachers feel unprepared and uncertain regarding writing instruction. Many teachers are not experienced or confident as writers themselves, and they are unprepared to act as curriculum developers (which is in effect what is expected of them in the absence of clear policies or organized materials and programs).

3. The organization of schooling and the multiple roles that teachers must play discourage extended and elaborate writing projects and make it difficult for teachers to respond constructively to student writers consistently. A teacher simultaneously acts as audience, coach, and evaluator of student writers. Unfortunately, teacher responses to student writing tends to be limited to product evaluation that focuses on the surface features of the language rather than on the meanings being communicated.

4. Rather than move students through lockstep sequences of skill drills, experienced teachers tend to develop loosely framed, long-range plans for writing and to emphasize flexible, activity-based plans for individual lessons.

5. While revision is difficult for them, students appear more willing to undertake it when their writing projects (assignments) have meaning in their lives beyond appeasement of the teacher. More generally, writing instruction is likely to be more effective when it emphasizes actual communication or realistic simulations rather than exercises calling for types of writing that students are unlikely to engage in outside of school.

General Mathematics

This project focuses on ninth-grade general mathematics courses, attempting to identify the reasons why these courses tend to be unpleasant and ineffective for both teachers and students, and to develop methods of improving their effectiveness.

Findings

1. Literature review and observation in general math classrooms identified several deterrents to success in these settings. Some of these stem from the fact that general math classes are populated by students who choose not to (or are not allowed to) take algebra. Poor attendance, poor study habits, and unrewarding teacher-student interaction are typical in such classes. Other deterrents to success are more directly related to the curriculum and instruction of ninth-grade general math: The content focuses heavily on basic mathematical concepts and operations that are already familiar to the students (even though they have not mastered them); this content is perceived as old and boring rather than new and interesting; and the students usually see the content as irrelevant to their present or future lives outside of school. Often the teacher and the students cooperate to develop a tacit arrangement that minimizes stress but also minimizes learning. The students cooperate by working relatively quietly on routine assignments, and the teacher cooperates by allocating most classroom time to such assignments and minimizing other, more demanding activities. This is one of the more common examples of the "bargain" described in the High School Standards project.

2. Teachers can be trained to improve the quality of day-to-day activities and ultimately to increase the levels of achievement observed in ninth-grade general math classes, although the process requires sustained training efforts that include experiences designed to attack the teachers' defeatist attitudes and increase their expectations about what can be accomplished, in addition to training in effective instructional practices.

3. Most of the instructional practices that are effective in improving ninth-grade general math classes are the same ones shown to be effective in other math classes: Increases in the proportion of time spent in active instruction by the teacher rather than in independent seatwork; increases in the proportion of the time that teachers spend explaining content and developing concepts; making sure that students understand what to do before releasing them to do it; monitoring seatwork and providing timely feedback rather than leaving students mostly on their own; modest homework assignments that are reviewed the next day; periodic reviews and tests; and use of classroom organization and management strategies that maximize task engagement and

minimize time lost to disruptions or transitions between activities.

4. Other strategies are of particular relevance to ninth-grade general math classes. One of these is inclusion of units on topics that are new to the students (such as probability and statistics).

5. Another is to wean the students and teachers away from their obsessive focus on computation exercises and other algorithmic tasks in order to stimulate them to think about and discuss mathematical concepts and perform tasks at a variety of conceptual levels. This involves engaging the students in talking more frequently about mathematics, focusing more often on the strategies for responding to problems rather than just on the answers to those problems, using richer and more specifically mathematical terminology and at the same time using more props and illustrations to help students grasp concepts in concrete and meaningful ways rather than merely attempting to memorize abstractions. Models, pictorial representations, and presentations of multiple examples of concepts are especially helpful for developing ninth-grade general math students' conceptual understanding of the content.

6. Besides improving general math students' conceptual understanding of the content, the conceptually oriented approach to instruction described in the previous paragraph actually improves the students' computational competence. In contrast, the typical computational approach featuring a steady diet of drill and practice tends to produce little or no growth in computational competence (as well as no growth in conceptual understanding).

7. The conceptually oriented approach is demanding of the teachers. Besides switching orientation from showing students how to do particular procedures to teaching them conceptual understanding of mathematics, the teachers must learn to remain more continuously aware of the students' conceptions (including possible misconceptions) of the content being taught and must be able to simplify or take apart that content in order to explain the material clearly in the first place and conduct effective remedial instruction when necessary.

8. Even after expectations have been heightened and skills have been developed, teaching a high-quality general math course remains a difficult challenge for the teacher. It requires more time spent planning, more determination to overcome student apathy or resistance, more ingenuity in finding effective examples and alternative ways to teach concepts, and more mobilization of the cognitive and emotional resources needed to

stay "sharp" throughout each class in order to make effective presentations and help students struggle with the material.

Science Teaching

This project has involved a series of studies on effective elementary and middle school science instruction, with particular emphasis on identifying and counteracting students' misconceptions about the content being taught.

Findings

1. Remarkably little science is being taught in elementary classrooms, sometimes none at all. It appears that recent emphasis on basic reading and mathematics skills has had the unfortunate side effect of squeezing science instruction out of the curriculum.

2. Many elementary school teachers are uncomfortable teaching science. These teachers focus primarily on the activities to be carried out: textbook reading, demonstrations, experiments, answering questions, and the like. They try to follow the recommendations in the teacher's guide, assuming or hoping that student learning will result, but they often are unsure about how the activities are supposed to contribute to learning. Frequently they do not understand the rationale for suggested activities, and they often unknowingly modify or delete crucial parts of the program.

3. Sometimes the activities themselves are ineffective or impractical. This is especially true of many of the experiments and "hands on" activities included in the science programs developed in the 60s and 70s. Many of these activities are too time-consuming, difficult, or cumbersome to implement.

4. Many elementary and middle school teachers who are more comfortable teaching science than the teachers described above are still ineffective because they rely on a didactic approach that focuses on presenting the content rather than on changing students' thinking. Their students memorize certain information and learn to respond to recall questions, but without seeing the broader implications of their answers or developing solid understanding of the underlying concepts involved.

5. This is especially likely to occur when the content involves scientific conceptions that contrast with certain common and powerful misconceptions developed through everyday experience. For example, students may study a unit on light and vision and even do well on tests over this content without fully grasping the notion that what we see when we see is reflected light. Such students will retain their preexisting misconception that light from the sun brightens an object so that we can see it, rather than adopting the scientific conception that light from the sun is reflected to the retina, and that it is this reflected light that we see when we "see the object."

   It is possible to eliminate such student misconceptions, but it is not easy. IRT research has found that teacher training must alert teachers to the nature and reasons for students' misconceptions and to the need to confront such misconceptions directly in interactions with the students. Substitution of clearer and more explicit text for the text that the students have been using is also needed.

6. Teachers must also know their students and the misconceptions that they bring to the content. Teachers' knowledge of the content of their subject matter is important, but by itself such knowledge is not enough to insure effectiveness in teaching that content to students.

7. Compared to elementary and secondary teachers, college level science instructors tend to be less open to input about student misconceptions and less willing to make the changes needed to overcome such misconceptions. This may be an important reason why such misconceptions are common even among otherwise well-educated adults.

Classroom Strategy Research

The Classroom Strategy Research project is concerned with teachers' thinking about and strategies for managing their classrooms and motivating and instructing their students. The classroom management work has focused on teachers' perceptions of and strategies for coping with students who present chronic emotional or behavioral problems. The motivation work has involved conceptualization and research on student motivation to learn and in particular on how teachers can affect the development of such motivation to learn in their students by modeling, projecting expectations and attitudes, and otherwise socializing their students' perceptions of and responses to academic activities.

Findings

1. Teachers' role definitions (their beliefs about what teachers are supposed to accomplish) affect their setting of goals, their allocation of time and energy to various activities, and their willingness to assume various responsibilities. In particular, teachers who include socializing students (fostering their personal adjustment and social relationships) in their definition of the teacher role are more willing to spend time on and assume personal responsibility for dealing with problem students than are teachers who believe that the primary role of the teacher is to instruct students in the formal curriculum.

2. Even so, socialization goals and good intentions do not guarantee success in socializing students. As a group, teachers who emphasized student socialization and spent a relatively large amount of time attempting to do it were no more successful at socializing their students than teachers who placed less emphasis on it. Presumably this is because the knowledge base concerning student socialization is limited, few teachers have received training in student socialization, and many of the techniques used by teachers in attempting to socialize students probably are ineffective or even counterproductive.

3. The most effective socialization probably involves integration of many commonly recommended techniques (didactic instruction, communication of expectations, modeling of attitudes and behavior, modifying behavior through reinforcement, developing close personal relationships with students, using inductive techniques designed to develop Golden Rule morality and empathy with others, and using counseling techniques designed to develop insights into the motives and reasons underlying behavior), rather than exclusive reliance on just one or two of these.

4. Although different strategies appear to be appropriate for dealing with different types of problem students, one constant is that the teacher must be prepared to

become involved personally in working with the student and seeking solutions. Teachers can and often should involve other professionals (administrators, counselors, social workers), but with the intention of getting assistance in working with the problem rather than turning the problem over to someone else and disclaiming further responsibility for dealing with it. Teachers who try to turn problem students over to someone else without becoming involved personally in working out the problem tend not to be successful with problem students.

5. Punishment or threat of punishment may be necessary to control antisocial behavior in certain students, but punishment is never a solution to the problem by itself. Effective socializers use the techniques described in No. 3 above rather than or in addition to punishment.

6. Teachers' attitudes toward and treatment of problem students vary according to the type of problem presented and the teacher's beliefs and attributions about its nature and causes. Teachers tend to be understanding, helpful, and supportive toward students whom they see as victims of mistreatment by others or of circumstances beyond their own control, but to be impatient, rejecting, and punitive toward problem students whom they believe to be misbehaving intentionally and refusing to change their behavior even though they have the capacity to do so. The concept of problem ownership can also be used to predict teachers' predispositions: Teachers are likely to be supportive of students who present student-owned problems (problems such as shyness or rejection by peers, in which the student's own needs are being frustrated), but to be punitive toward students who present teacher-owned problems (problems such as defiance, disruption of the class, or persistent underachievement, in which the student's behavior frustrates the teacher's needs). Such teacher predispositions are merely special cases of general human response tendencies in conflict situations. Given that some of them are counterproductive in terms of positioning teachers to solve problems effectively, however, methods are needed to alert teachers to these problems and train them to respond more professionally and effectively.

7. Teachers' expectations can have the effect of self-fulfilling prophecy on students if they are consistently communicated to the students. Although most attention has focused on the topic of expectation effects on student achievement, similar expectation effects occur in other domains as well. If anything, we might expect more powerful teacher expectation effects on affective or social outcomes than on

cognitive outcomes. Students are more likely to follow classroom rules and procedures when their teachers expect them to than when their teachers expect to be ignored or defied; students are more likely to cooperate and get along well with one another when their teachers expect them to than when their teachers expect hostility and aggression; and students are more likely to find classroom activities motivating and meaningful when their teachers expect them to than when their teachers expect them to be bored or alienated.

8. Teacher praise has been both oversold and misconstrued by theorists offering advice to teachers. Behaviorists treat praise as a form of social reinforcement and recommend it as a technique for controlling student behavior. In reality, praise is a weak reinforcer for most students and appears to be used best when used sparingly to help students appreciate their accomplishments (especially major accomplishments attained through sustained effort) rather than when used routinely in an attempt to control students by "reinforcing" relatively minor and routine behaviors. Self-concept theorists sometimes picture students as greatly in need of a continuing stream of praise from their teachers, and suggest that praise routinely has powerful positive effects. In reality, much praise is ineffectual because it is too brief or vague to have much impact, and some praise is counterproductive because it embarrasses the recipient (especially if it is public praise delivered as a response to compliance with rules or procedures rather than as a reaction to more praiseworthy accomplishments)

9. In general, teacher praise is likely to have desirable effects on students when it is delivered privately rather than publicly, directed to noteworthy accomplishments achieved with notable effort rather than to minor accomplishments or conformity to rules and procedures, specific in identifying what is praised and detailing the reasons why it is praiseworthy, focused on the absolute value of the accomplishment or the degree to which it represents improvement over prior accomplishments rather than on comparisons with the accomplishments of others, and phrased in language that calls attention to the accomplishment itself rather than to the teacher acting in the role of authority figure or expert. (Training in effective praise based on these guidelines has been included in the inservice program developed by the American Federation of Teachers).

10. Psychologists' conceptions of motivation are relatively unhelpful and sometimes misleading to teachers. Given the purposes of schooling and the nature of classroom activities, teachers should be concentrating on developing student motivation to learn (defined as

student predisposition to take academic activities seriously and attempt to get the intended knowledge and skill benefits from engaging in them). Motivational approaches based on controlling behavior through incentives or reinforcement stop short of developing motivation to learn. They apply primarily to the performance that occurs subsequent to learning rather than to the original learning itself, and they focus on the consequences of success or failure in these performance situations. Such emphasis on extrinsic considerations not only fails to focus attention on the goals and processes of learning, but can have the effect of eroding whatever intrinsic motivation may be present. Other popular conceptions also fail to focus directly on student motivation to learn. Work on achievement motivation stresses performance rather than learning and focuses on success or failure in meeting performance standards rather than acquisition of knowledge or skill in the first place. Also, this approach construes achievement motivation as a need that impels the student much like extrinsic factors do, rather than as a more intrinsic form of motivation that features voluntary and self-regulated attempts to acquire knowledge and skill. Work on the concept of intrinsic motivation comes closer to the notion of motivation to learn, but it applies more clearly to the affective aspects (liking for tasks) involved in selecting tasks under free choice or recreational conditions than it does to the more cognitive aspects of motivation to learn academic tasks in the school setting. Student motivation to learn involves making the best of the school situation by cognitively engaging in academic activities with the intention of acquiring the knowledge or skills that these activities were designed to develop, whether or not one likes the activity and even though the activity is prescribed externally rather than self-chosen.

11. Observations and interviews of students rarely reveal much evidence of student motivation to learn. Furthermore, classroom observations suggest that most teachers seldom say or do things likely to develop such motivation to learn and often do things to undercut it (such as by suggesting that academic activities have little value or that the students are not expected to enjoy them or benefit from them). However, there is reason to believe that teachers could develop student motivation to learn if they were to inform students consistently about the purposes and expected benefits to be derived from academic activities; to model enjoyment of learning as a self-actualizing activity and communicate the expectation that students will find it similarly rewarding; to use examples, anecdotes, or illustrations that make abstract material concrete and meaningful to the students; to personalize the material and relate it

> to students' existing experiences and interests, and so on. A teacher's manual describing 24 strategies for developing intrinsic motivation and student motivation to learn in classrooms has been prepared and is being used as the basis for an ongoing IRT study. (In addition, this material is being used as the basis for a series of workshops on motivation to be included in the second generation of inservice workshops being developed by the American Federation of Teachers).

Socialization Outcomes

This project has looked at the similarities and differences in classroom activities, patterns of teacher-student interaction, and patterns of student outcome in classes taught by teachers who place varying emphasis on three broad sets of goals: (a) the academic goals involved in instructing students in the formal curriculum; (b) the socialization goals involved in developing individual work habits and assuming personal responsibility for academic performance; and (c) the socialization goals involved in teaching students to function as constructive members of the group and to develop social responsibility in the classroom. Teachers who stress one of these three goal clusters at the expense of the other two are being studied, along with teachers who have more balanced goal profiles.

Findings

1. In addition to the socialization goals concerning individual traits that have been stressed by psychologists (self- concept, achievement motivation, autonomy, persistence, etc.), teachers work on socialization goals that apply to the class as a group (developing a convivial classroom atmosphere marked by prosocial and supportive interactions with peers). Much of this socialization is accomplished through what is said and done with the class as a whole rather than (or at least in addition to what is said and done with individual students. Year-to-year consistency in teacher effectiveness in reaching these socialization goals

is comparable to the consistency achieved in reaching academic achievement goals.

2. As is the case with achievement goals, teachers' levels of success in reaching socialization goals appear to depend in part on teachers' expectations for their students. Many of the least successful classes were in schools serving low socioeconomic status populations where teachers did not do much to promote the learning of personal and social responsibility because they believed that their students would not profit from their (the teachers') efforts in these domains.

3. Teachers who are especially effective in helping their students to develop independent work habits and assume personal responsibility for their learning in the classroom make it clear to their students that they want them to assume such responsibilities. They make it clear to their students that they expect them to manage their study time effectively, to check their work, to seek help if they do not understand something, and to make decisions about when and how to accomplish their assignments. In addition, they instruct the students in strategies for meeting these expectations, and establish a predictable learning environment that enables students to know when and how to get information or help when they need it. On these and other matters dealing with the students' individual responsibility as learners, the socialization provided by these teachers goes far beyond that provided by teachers who are satisfied if their students were quiet and cooperative.

4. Teachers who emphasize classroom atmosphere and social responsibility tend to stress cooperation and prosocial behavior in stating their expectations to their students and are likely to use activities such as peer tutoring or small-group cooperative activities that provide students with chances to work together with one another.

5. In general, the data suggest that teachers with balanced goals tend to get better results than teachers who stress one set of goals at the expense of others. In particular, teachers who stress classroom atmosphere and group interaction goals at the expense of academic achievement goals and student responsibility goals seem to be less effective in all three domains than other teachers.

Conceptual Analytic Project

This project complements IRT's empirical work by providing conceptual analysis and logical and philosophical criticism of ideas and practices recommended to teachers. It emphasizes assessing the adequacy and completeness of the rationales underlying recommended practices, identifying hidden assumptions or unrecognized complications that limit practical application, and clarifying important differences between seemingly similar ideas.

Findings

1. Despite the emphasis placed on it in the literature, experience is not necessarily an effective teacher (unless there is accurate monitoring of what is happening as it occurs and sufficient reflection on this information afterwards, the person may learn little or nothing from the experience), and sometimes it is a bad teacher (low expectations may seem to be confirmed and inappropriate habits may become strengthened when persons are left on their own to cope with situations as best they can, without information about better alternatives). This calls into question the notion that schooling should concentrate on content that is familiar to the students, preferably content that relates to their prior experience. This can be seen as another way to keep the poor poor while the rich get richer. The role of practical experience in constructing learning situations needs careful thought. Ideal instruction will provide breaks with ordinary experience, not just more of the familiar.

2. This same point applies to teacher education, as well. Good teacher education broadens rather than merely reinforces the neophyte teacher's experience, and it challenges overly generalized or rigid ideas developed on the basis of that experience. One implication here is that course work is probably undervalued and student teaching and other field experiences overvalued by preservice teachers. Additional field experience will not necessarily improve a teacher education program, especially if the student teachers are not equipped with concepts for understanding their experiences or required to reflect on those experiences in systematic ways.

3. Research on teaching develops a knowledge base for teachers and teacher educators to draw upon in making decisions about good practice, but such research cannot mandate practice or provide specific implications for teaching or teacher education in any direct way. Thus, terms such as "research into practice" or "implications of research for practice" are misguided if they are taken to mean that definitions of effective teaching or specific prescriptions about how to teach can be established by "applying" research findings. Scientific data can supply information about the effects (typically trade-offs rather than exclusively desirable or undesirable outcomes) of following particular courses of action, but policy decisions about what actions to take will depend on the nature and relative importance of adopted goals and the constraints that must be worked within when seeking to realize those goals. Thus, in making decisions about what and how to teach, practitioners will need to rely not only on scientific information but on their values and their knowledge about the opportunities and constraints built into the situation.

High School Standards Project

This project, following up on an earlier study on communication networks among high school faculty and students, investigates the nature of the standards of achievement to which students are held in various high schools and the factors that affect the setting and enforcement of these standards.

Findings

1. Until it began to be reversed recently, there had been a gradual retreat from course requirements and other fixed standards of excellence over the last 20 years in American high schools. Teachers were given more autonomy to decide what to teach, and students were given more opportunity to take optional rather than required courses. Although these changes brought some advantages (increased specialization and diversity that probably met more students' individual needs and interests than previously), the net effect appears to have been more negative than positive.

2. Rather than accepting guidance from leaders in their particular academic disciplines or working together to discuss and agree on curricular issues, teachers tend to decide what to teach according to their perceptions of what is "best for the kids." In practice, these decisions are heavily influenced by the teachers' own interests (including hobbies and avocations in addition to knowledge in their academic disciplines) and by the response of a small subset of students who share those interests (rather than "the kids" in general). As a result, many of the electives offered to high school students are offered because the teacher enjoys the content rather than because there is some consensus on the value of exposing students to that content.

3. Because school funding is linked to school enrollment, and because elective courses must be sufficiently popular with students to justify keeping them in the curriculum, both administrators and teachers give heavy consideration to effects on enrollment when making decisions about school policies and curriculum offerings (and presumably, give correspondingly less weight to considerations such as curriculum content or standards).

4. Another factor contributing to the retreat from standards is limitations on teachers' time. Teachers who must instruct 150 students each day are unlikely to assign term papers, research projects, or other work that will require them to spend a great deal of their time reading and correcting papers, even if they do not have other significant demands on their time. Furthermore, most high school teachers do have such demands. Most have at least one part-time job besides teaching, and many have another full-time job or a combination of part-time jobs that take up 40 hours or more per week.

5. As a result of these and other pressures, many teachers in most high schools have made tacit agreements with their students that have the effect of avoiding sustained, rigorous academic inquiry. In an effort to make schools more pleasant for the students, the teachers tolerate, and sometimes encourage, diversions from the academic content. Furthermore, both teachers and students substitute genial banter and conversation for concentrated learning activities. As a result of this implicit bargain, academic content is sacrificed for comfortable classroom social relations, and curriculum and instructional methods are adapted to student preferences.

6. Most students encourage or at least passively accept these trends because they have been taught to view high school primarily as a place to acquire a diploma needed

for socioeconomic advancement, and not as a place for learning important knowledge and skills. Reductions in course requirements and academic standards make it easier to obtain the diploma and lead to reductions in time spent studying or doing homework and increases in time spent in recreation or paid employment.

7. Significant changes in the system as it has developed will not be made easily, because it is necessary to overcome the inertia produced by these factors. In particular, teachers will be reluctant to surrender the autonomy they have acquired in recent years, and students will resist attempts to hold them to higher standards of achievement.

Teacher Planning

In addition to studying the nature and effects of teachers' instruction in the classroom, the IRT has been a leader in studying the planning, thinking, and decision making that goes into preparing for classroom instruction.

Findings

1. Teacher education programs concentrate almost exclusively on lesson planning, but inservice teachers also do yearly planning, unit planning, and weekly planning. Unit and weekly planning are especially important and deserve more attention.

2. Good planning is marked by thoroughness but not rigidity. Teachers who make overly rigid and detailed plans sometimes concentrate too much on presenting the content and not enough on responding to the students' needs, and they fail to take advantage of the "teachable moments" that come up when students ask questions or make unanticipated responses.

3. Experienced teachers work from sketchy plans rather than the detailed plans developed by neophytes. In working through lessons, they are guided more by images of what the lesson will be like and how it should proceed (based on past experience) than by specific written plans.

4. Teachers do not tend to concentrate on a lesson's objectives and curriculum concepts when planning. Instead, they concentrate on making sure that they have

> the necessary equipment and are prepared to execute the behaviors called for in the lesson, and they think about adapting the lesson to their students, stimulating student interest, and ensuring student attention and active participation. Thus, immediate interaction processes and social system concerns take precedence over curriculum and instructional concerns in daily lesson planning. Although the interactional and social system concerns appears to be appropriate and useful, the relative neglect of instructional objectives appears problematic, especially in light of other IRT research indicating that students are often only dimly aware of the purposes of academic activities and have difficulty explaining what they are learning and why they are learning it.

Language Arts Project

The Language Arts project investigated issues in elementary school language arts instruction, particularly issues involving the allocation of time to language arts instruction and the degree to which language arts instruction is encapsulated within specific language arts subareas (reading, writing, spelling, etc.), integrated across these subareas, or included in instruction in subject matter areas other than language arts.

Findings

1. Teachers' beliefs about subject matter priorities are strongly related to their allocation of instructional time. Most teachers allocate 30-45% of the school day to reading and language arts instruction, but within this, there is considerable variation in the amounts of time allocated to reading, spelling, writing, and other language arts objectives.

2. Teachers generally favor the integration of language arts instruction with instruction in other subject matter areas when asked their opinions on the matter, but classroom observations revealed only minimal evidence of such integration actually taking place.

3. Teachers who were observed to practice integration of language arts instruction with instruction in other

subject matter areas tended to spend more time than other teachers in the fine arts (literature, music, and art).

4. Relatively little integration is achieved through basal readers. In one sense, the content of these readers varies tremendously. However, most of this variation occurs within the form of fiction (primarily short stories). Basal readers contain very little nonfiction prose, and virtually none of this is content from the other subject matter areas (math, science, social studies).

Prospective Teachers' Interactive Decisions

This project investigated the nature of and rationales for the interactive decisions (decisions made during actual instruction) made by prospective teachers and compared them with those of experienced teachers. In particular, it focused on decisions about how to respond when the teacher asked a question and then called on a student who failed to answer the question correctly.

Findings

1. In a simulation study, prospective and experienced teachers were provided with vignettes describing a situation in which a student failed to answer a question correctly. A student was described in terms of race/ethnicity (black, Hispanic, or white), gender (male or female), ability (low, average, or high), and task engagement (on- or off-task). The prospective and experienced teachers gave generally similar responses to these vignettes.

2. The teachers reported the most willingness to sustain the interaction (stay with the student and try to elicit an improved response by rephrasing the question or giving a clue, rather than terminating the interaction by giving the answer or calling on someone else) when the student had been depicted as on-task or as of low ability. Apparently, the teachers believed that attempts to improve the quality of the student's response had a good chance to succeed with on task low-ability students, but were unlikely to succeed with high-ability students, especially those who had been off task when called on.

3. The teachers' response decisions were not influenced significantly by the gender or race/ethnicity of the depicted students.

4. In addition to being questioned about their hypothetical decisions in response to vignettes, the prospective teachers were interviewed concerning actual decisions they had been observed to make in the classroom. In these interviews, the prospective teachers were able to give reasons for why they called on particular students in the first place as well as why they responded as they did to the students' answers.

5. Other research on prospective teachers' thinking and decision making suggests that such teachers are concerned with survival and interpersonal relationship issues (group management, the affect and task engagement of individual students, and the teacher's own affect and subjective well-being). In contrast, the responses of these prospective teachers concerning their interactive decision making suggests that they were concerned primarily with issues of curriculum and instruction (what facts or concepts they wanted to elicit in the process of putting across the content to the group). It is not yet clear whether these differences were due to differences in stage of teacher development (perhaps these teachers had already worked through most of the low-level survival and interpersonal concerns that tend to preoccupy beginning student teachers), to differences in teacher preparation (perhaps something in their teacher education programs caused these student teachers to be more focused on curriculum and instruction than on survival or interpersonal relationships than is typical), or to other factors.

6. As with the simulation study, the findings from the observation study suggest that teachers' responses to student failure to answer questions correctly were affected by student ability levels but not by student race/ethnicity or gender. More fundamentally, however, it appears that decisions about whether or not to sustain the interaction with the original respondent are based less on that student's general status characteristics than on judgments made in the immediate situation about the student's potential for coming up with a correct response if given help. Prospective teachers are likely to sustain the interaction and attempt to elicit an improved response if they believe that rephrasing the question or giving clues are likely to succeed in enabling the student to produce an acceptable response.

Knowledge Use in Learning to Teach

The Knowledge Use in Learning to Teach project was a longitudinal study of a group of prospective teachers who were interviewed periodically as they entered and moved through their teacher education programs. The interviews focused on the beliefs of these prospective teachers concerning teaching and learning to teach and on the nature and sources of the knowledge they sought to acquire in the process of becoming a teacher.

Findings

1. Prospective teachers enter teacher education programs with many beliefs, ideas, attitudes, and values concerning teaching, learning, learning to teach, and knowledge generally. These preconceptions or prior commitments may both contribute to and interfere with their professional development, underscoring the fact that teacher education, like classroom teaching, is profitably viewed as a process of conceptual change rather than as a process of infusing knowledge into a vacuum. Teacher education courses could profitably take these preconceptions into account (by building on prior knowledge or challenging inappropriate views, as appropriate), but few such courses are designed even to elicit information about such preconceptions, let alone to capitalize on them as entry points for instruction.

2. Teacher educators typically portray theory and research as the knowledge base of teaching and socialize prospective teachers to believe that they must master this knowledge base and then apply it in the classroom. This view distorts the relationship between research and practice (see previous section on the Conceptual Analytic Project), and it fails to convey the fact that field experiences are sources for developing professional knowledge and not just places for applying such knowledge. Teacher educators usually have little to say about the kinds of knowledge that can come only from ongoing experience with pupils and do not do much to prepare prospective teachers to acquire this practice knowledge systematically. Effective reform of preservice teacher education will require change in these views of the sources and nature of professional knowledge in addition to change in the content of the curriculum.

3. Despite this emphasis on knowledge use in their teacher preparation programs, prospective teachers tend to develop a "trial and error" approach to teaching. They believe that they will have to figure out "what works" for themselves. They typically see this trial and error process as idiosyncratic, failing to appreciate the need for applying professional standards for judging whether or not something "works."

4. Teacher educators tend to underestimate what is entailed in learning to use (or apply) new concepts or skills in the classroom, and what it means to "learn from experience." They advocate knowledge use but rarely teach students how to go about it, they do not explicitly address the issue of learning from experience, and they do not focus on what it means for something to "work" in the classroom. On one hand, students are enjoined to apply a commonly shared body of scientific knowledge, while on the other hand, their beliefs in a personal and idiosyncratic approach to teaching are left unexamined, unchallenged, and undeveloped.

5. Evaluation of prospective teachers tends to emphasize skillful performance (mastery of concepts and skills taught in courses and rated ability to pull it all together and demonstrate competence in the classroom). Although prospective teachers are told that learning to teach will continue into their years on the job, they are evaluated more on their performance than on their ability to take a critical or experimental stance toward their developing practice.

6. Prospective elementary level teachers tend to have limited subject matter knowledge and in fact rarely have a solid grounding in any subject area. Teacher education courses focus mostly on pedagogical knowledge and do not build up these prospective teachers' knowledge of mathematics, political science, or literature.

7. In the absence of explicit help that would enable them to get inside of their teaching subjects and know them well, prospective teachers tend to develop a generic, process view of teaching that includes a belief in autonomous decision making as a good in itself (e.g., that individual teachers should decide for themselves what to teach and how to teach it). These beliefs influence their planning, selection of instructional content, and criteria for judging success.

8. Instead of trying to teach prospective teachers how to use curricular materials appropriately, teacher educators tend to assume that the prospective teachers have sufficient grounding in subject matter to enable them to make independent curricular instructional

decisions. They tell prospective teachers that "professional teachers" do not follow textbooks and urge them to critique published curricular materials and develop their own units. However, during student teaching the prospective teachers typically work with cooperating teachers who rely on basal textbooks, and they find that adapting or even following textbooks is not easy. At the same time, their attempts to develop curriculum reveal the limits of their knowledge of both subject matter and pedagogy. Rather than urge novice teachers to create their own curricula, it may be more appropriate for preservice teacher preparation programs to teach beginning teachers how to adapt textbooks and use them wisely.

9. Preservice teacher preparation is best viewed as a phase in the process of learning to teach rather than as synonymous with learning to teach. It is a phase of formal study preceded by a long period of informal learning about teaching and succeeded by an intense period of learning on the job. This view has implications about the curriculum of preservice teacher preparation and about what are appropriate aims for this phase of learning to teach. In particular, it suggests that the central tasks of preservice teacher preparation are (a) helping novices get a good grounding in subject matter; (b) helping them make a transition from commonsensical to professional ways of thinking; (c) preparing them to learn from their own teaching; and (d) helping them to develop a professional role orientation.

10. The concept of pedagogical thinking is useful in characterizing the transition from commonsensical to professional ways of thinking about teaching. Thinking pedagogically means thinking in terms of ends (goals) and means (activities, materials, etc.), paying attention to pupils' thinking and learning, and considering how to build bridges between the pupils' understanding and the teacher's understanding. Pedagogical thinking is different from both commonsense ways of thinking and disciplinary ways of thinking.

11. Experiential learning is a very important source of new knowledge about teaching, but it also entails several potential problems. These can be viewed in terms of three potential pitfalls: (a) the familiarity pitfall; (b) the two-worlds pitfall; and (c) the cross-purposes pitfall. The familiarity pitfall focuses on the fact that prospective teachers are already quite familiar with classrooms and may tend to confuse what is familiar with what is necessary or appropriate. The two-worlds pitfall focuses on potential conflicts between the expectations and rewards built into the university course structure and those built into the

schools in evaluating prospective teachers. The cross-purposes pitfall focuses on the difficulties that stem from the fact that the classrooms in which prospective teachers undertake field experiences are established primarily to educate the pupils in those classrooms and not primarily as settings for preparing novice teachers. The cooperating teachers must concern themselves primarily with fostering their pupils' learning, and these responsibilities may get in the way of fostering the learning of a visiting prospective teacher.

12. Student teaching is typically viewed as a capping experience or culmination of teacher preparation and a time to apply what has been learned in courses. Less well recognized is the fact that student teaching marks a beginning in learning to teach because for the first time the novice is in a position to start learning about the role of practical knowledge in teaching. It is true that student teachers need opportunities to make connections between formal knowledge from their courses and the realities of working in classrooms, but exclusive emphasis on application of formal knowledge may divert attention from the development of practical knowledge that can be learned only from teaching itself and from interacting with pupils over time in classrooms. Infusion of better mechanisms to ensure reflection on field experiences and changes in the ways that student teachers are evaluated appear to be needed if the potential for student teaching experiences to develop practical knowledge is to be realized.

CONTENT DETERMINANTS

Teachers are given a broad range of advice and directives about the nature of the content they ought to be teaching their students. Textbook publishers, test developers, school curriculum guides, teacher educators, content specialists, school boards, and parents are just some of these "advisors." This set of studies examines how content decisions are made by teachers in response to these multiple and frequently conflicting recommendations. In addition, the research seeks to account not only for why teachers teach certain topics and not others but also for the amount of time spent on subject, the degree of mastery demanded, and the extent to which different students are taught different content.

The research has focused on elementary school mathematics. Early studies revealed that elementary teachers' decisions about the math content they taught were influenced by a wide range of factors. The researchers also found that teachers had only limited knowledge about the content measured on standardized achievement tests and that there was frequently a poor match between the content covered in school-selected textbooks and the content included on the standardized tests--even when both text and test were produced by the same publishing company.

These IRT studies reveal that teacher susceptibility to influence from policies concerning content is greater than previous research on change would suggest. The project team is now engaged in research to identify the specific ways in which state, district and school policies determine what teachers teach. Policies of interest include minimum competency testing of students, requirements concerning curriculum objectives, requirements for promotion from grade to grade, and mandated textbooks.

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CONTENT DETERMINANTS

Teachers determine what is taught in school. They create opportunities for students to learn the knowledge, skills, and dispositions that influence future productivity in school and in the social and vocational worlds beyond school. Teachers influence this effect by deciding what content to teach and by implementing strategies to engage students in that content.

This proposition has served as the central hypothesis for a line of research undertaken at the Institute for Research on Teaching (IRT). This paper summarizes what has been accomplished from those inquiries. New theoretical constructions have evolved to support analyses of school content and the methods used to determine school content. These constructions and their empirical bases have proven to be powerful mechanisms to understand practice and the ways it might be improved. The constructions also serve to elevate the importance of content in research on teaching and research on educational policy.

Starting With Content

Distinguishing between the content (what is taught) and the strategy (how content is taught) of instruction ensures consideration of each (Freeman, 1978). Only if instruction centers on important content does it have potential for being worthwhile. Yet, until recently, most researchers have taken content for granted, focusing their attention on methods instead (Schwille, Porter, & Gant, 1979; Schwille et al., 1979). Hesitancy to confront issues of what should be taught is understandable. Value judgments are required that cannot have their justification in empirical fact.

Distinguishing content from strategy elevates the importance of content and raises new questions. A framework which clarifies the distinction between content and strategy has evolved from IRT research. Teachers determine (a) how much time is allocated to a subject, such as mathematics, over the course of a school year, (b) what topics are taught, (c) to which students, (d) when and in what order each topic is taught, and (e) to what standards of achievement (Schwille et al., 1982). Collectively, these five decisions determine student opportunity to learn, a major influence on student achievement (e.g., Barr, Dreeben & Wiratchi, 1983; Carroll, 1963). They specify areas of content decision making for teachers, separate from decisions about strategy. They suggest a series of questions that teachers, policymakers and consumers of education can use to monitor the content of schooling. They form the dependent variables in IRT research on teacher content decision making.

Understanding content also requires operational definitions of topics within a content area. Elementary school mathematics serves as the focus for IRT research on content decision making. Mathematics is a basic skill learned primarily in school. Because of the many important mathematics topics and the limited amount of school time allotted for them, decisions about what content to include in the curriculum are crucial. Nevertheless, elementary school mathematics provides a conservative test of the importance of teachers' content decisions because most people believe the content to be fairly standard (e.g., fourth graders study multiplication).

A three-dimensional taxonomy to describe the content of elementary school mathematics provides definitions of topics that may or may not be studied in elementary school (Kuhs et al., 1979). The three dimensions of the taxonomy describe general intent (e.g., conceptual understanding, skills, applications), the nature of material presented to students (e.g., fractions, decimals), and the operation the students must perform (e.g., estimate, multiply). The terminology and specificity of the taxonomy are based largely on an interview study of content distinctions made by elementary school teachers (Schmidt, Porter, Floden, Freeman & Schwille, in press). Specific topics are represented by the intersections of these three dimensions (e.g., story problems involving addition of fractions, basic multiplication facts, understanding the relationship between multiplication and division). More general topics are addressed by the marginals of the taxonomy (e.g., emphasis given to conceptual understanding). Because topics can be defined at different levels of specificity, because the taxonomy has a structure which makes clear both what is taught and what is not taught, and because the distinctions made reflect ways in which teachers think and talk about their mathematics instruction, the taxonomy, when coupled with the other four attributes of content decision making, provides a language to support deliberations about content by practitioners, policymakers, and researchers (e.g., Freeman, Kuhs, Knappen, & Porter, 1982; Porter, 1983a).

The results from content analyses of instructional materials illustrate the power of this taxonomy of elementary school mathematics topics. Analyses of four commonly used fourth-grade textbooks and the five most commonly used nationally normed standardized tests of mathematics achievement (at the same grade) reveal that of the 385 topics covered by at least one of these published materials, only six topics are common to all nine. Among the textbooks, 19 topics define a core curriculum on which approximately half of the exercises in each book are focused, but the other parts of the books are idiosyncratic in their topic coverage (Freeman, Kuhs, et al., 1983). The image of a national curriculum in elementary school mathematics begins to fade, and the problems of curricular validity in educational assessment begin to emerge (Floden, Porter, Schmidt & Freeman, 1980; Porter, Schmidt, Floden, & Freeman, 1978; Schmidt, Porter, Schwille, Floden, & Freeman, 1982; Schmidt, 1983).

The Role of the Teacher: Bounded Rationality

At least in elementary school mathematics, teachers serve as political brokers in the process of content determination (Lipsky, 1980; Schwille et al., 1982). Teachers have some discretion to follow their own convictions but they are subject to a variety of factors that bear on their content decisions. Decisions about academic content, however, are not always primary for teachers. Teachers often plan in terms of activities rather than content outcomes (Clark & Yinger, 1979); for many elementary school teachers, academic content takes second place to other goals of schooling, such as promoting good citizenship among students (Prawat & Nickerson, 1985).

In the absence of other advice, teachers are likely to follow their own repertoire and convictions. They will teach what they have taught before, what they feel comfortable with, and what they deem appropriate for their students. But teaching does not take place in a vacuum. Advice on what to teach comes from a variety of sources and in many different forms. Students and their parents can have direct and indirect effects on what is taught. Other teachers, the school principal, the district curriculum coordinator, a university professor all serve as potential sources of advice, as do materials and position statements from professional organizations. These interpersonal and organizational influences bear directly on teachers and operate in addition to federal, state, district, and school policies. Mathematics objectives, testing programs, mandated textbooks, promotion policies, and time guidelines all address aspects of content decision making.

The teacher stands between the content messages from these various sources and the students to be taught. The effects of advice or prescription on what to teach are mediated by the teacher's own convictions about what should be taught. To have an effect on a teacher's content decisions, then, an external influence must either change the teacher's conception about what is most desirable (i.e., persuade the teacher) or override the teacher's beliefs, forcing the teacher to comply even though the request is not viewed as appropriate. Effects of both types have been found, although persuasion is clearly the dominant form (Schwille et al., 1986; Floden et al., 1986; Porter, 1983).

Sources of Influence

An Overview of Five Studies

Two early studies of teacher content decision making in elementary school mathematics led to increased attention on school policies

(Floden, Porter, & Schwille, 1980; Schwille et al., 1982). In both of those studies school policies appeared to be among the strongest influences on what is taught, after the teacher's own convictions. Policy effects were not uniform, however, and the range of policies considered was limited. Based on that early work and previous analyses of educational policies (particularly Spady & Mitchell, 1979), a fourfold structure was hypothesized for explaining differences in policy strength.

Policies can vary in their prescriptiveness, consistency, authority, and power. Prescriptiveness refers to the extent and specificity of a policy in telling teachers what to do. A mandated textbook is less prescriptive than a mandated textbook that teachers are instructed to follow closely, starting at the beginning and carrying through to completion. Consistency refers to links among policies, describing how policies can contradict or reinforce each other. For example, a mandated textbook may be tied to mathematics objectives through a guide that describes pages in the book on which material is found for each objective. Policies can gain authority through appeal to law, social norms, expert knowledge, or support from charismatic individuals. Rewards and sanctions tied to policies give them power. Five studies have been completed, each of which addresses a different aspect of teacher content decision making in elementary school mathematics and all of which provide empirical tests of the four-attribute structure for describing the strength of content policies.

The earliest study (1978) used policy-capturing methodology to investigate the effects of six possible sources of advice on teachers' topic selection: a district mandated textbook; objectives published by the district; tests with results published by grade level and building in the local newspaper; advice from the principal; advice from upper grade teachers; and advice from parents (Floden et al., 1980). Sixty-six fourth-grade teachers were asked to imagine they had transferred to a new school and were to teach a class of fourth graders capable of fourth-grade work. They were then asked how likely they would be to add five topics that they had not been teaching and how likely they would be to drop five topics they had been teaching.

A second study (1979-1980) moved the work from the controlled setting of simulations to the real world of classrooms. Seven third- through fifth-grade teachers in six schools across three school districts were studied for a full school year to determine the mathematics content they taught, the advice they received concerning what should be taught, and the relationships between the two. Content was described through daily teacher logs (collected weekly). Advice was monitored through interviews (weekly), questionnaires, observations, analyses of district and state policies and practices, and by attending meetings with the teachers or district-level meetings at which mathematics content might be discussed. The findings from these first two studies led to the design and completion of a series of three studies focusing on the nature and effects of state- (1981), district- (1982), and school-level policies (1982-1985).

For the study of state policies, seven states were selected to represent variation in types of policies, overall strength of policies, and school populations served: California, Florida, Indiana, Michigan, New York, Ohio, and South Carolina (Schwille et al., 1986). For each state, a complete set of documents on relevant policies and practices was assembled (e.g., objectives, testing, textbooks, allocation of time, school evaluation, teacher qualifications and promotion of specific topics). Documents were identified and additional information collected through interviews with knowledgeable persons in each state (an average of eight persons per state).

In the second of the three studies, district policies, their relationships to state policies, and their perceived effects were studied in five of the seven states (Floden et al., 1986). Questionnaires were used to collect information from district mathematics coordinators, principals, and teachers using a probability-in-proportion-to-student-enrollment design for each state. Questionnaires asking about the nature of policies and their perceived effects were designed along the lines of the four-attribute structure to describe policy strength.

The third and final study once again brought the work back to the classroom. The effects of state-, district-, and school-level policies were examined for 32 fourth- and fifth-grade teachers in six Michigan school districts (Porter, 1986). Teachers provided descriptions of their daily mathematics instruction during 1982-83, using teacher logs and weekly questionnaire for each of three target students (differing in perceived ability). Districts were selected to contrast types of content relevant policies; schools were selected to contrast student body socioeconomic status; teachers were selected to contrast grouping practices when teaching mathematics. Teachers were interviewed and completed questionnaires over a three-year period to provide information on their content decision making and on their understanding of school, district, and state policies and practices concerning mathematics content. District curriculum coordinators were also interviewed over the same three-year period and documents describing district policies and practices identified in those interviews were obtained so that shifts in district policy formulation over time could be monitored. Principals were interviewed at the time teacher logs were collected to determine school-level policies and practices and to understand how principals promote state and district policies and practices.

Weak Policies, Strong Effects

The five studies provide insight into the nature of content policymaking at the state, district, and school levels and the influences of those policies on teachers' practices. The picture that emerges is one of relatively weak and fragmented policies when judged against the attributes of prescriptiveness, consistency, authority, and power but also one of increasing policy activity over time. States, districts, and schools differ sharply in their approaches to content policy formulation. New York, South Carolina, Florida, and California have policies similar to the centralized national school systems of Europe; the policies specify what to teach and to what standards, although even these states differ in the extent to which their policies appear to challenge teacher practice. The policies of other states, such as Indiana and Ohio, operate indirectly, imposing requirements on school districts without directly telling teachers what to do. For example, Ohio has no state testing program, but the state requires school districts to have their own testing programs. Some states, such as Michigan, place great trust in local school districts and the individual classroom teachers, avoiding prescriptions about what should be taught and to what standards of achievement (although even Michigan has a minimum objectives testing program that districts and teachers may look to for guidance, Schwille et al., 1986).

Like states, districts also differ in the breadth and strength of their content policies. A relationship, however, exists between state and district policy practices; district policy formulation is more active in states which are also active in content policy formulation. Districts tend to extend and elaborate state policies rather than fill in areas in which states have not been active (Freeman, 1983; Cohen, 1982).

At least in elementary school mathematics, policies tend to be only mildly prescriptive; nor are they carefully constructed to be mutually reinforcing (although neither do they contradict each other). Little evidence exists which ties teacher compliance to rewards and sanctions, nor do teachers view this to be the case. Rather, policies attempt to persuade and gain their strength through appeals to authority. Involving experts (both teachers and mathematics education experts) in the formulation of policies is the most common method for giving authority to policies. Considerable attention is also given to building policy strength through appeals to legal authority, consistency with social norms, and support from charismatic individuals (Floden et al., 1986).

Because policies rely on authority more than on power, teachers' conceptions of appropriate topics to teach are generally reflected in the policies teachers adopt. Thus, unless there is a push in a new direction, even when policies are discontinued teachers tend to continue their content practices as though the policies were still in effect.

State, district, and school content policies are relatively weak (at least from a theoretical perspective); thus, their influence on teacher content practices is surprising. Virtually every teacher studied has had his or her mathematics instruction influenced in important ways by one or more school policy. Yet the effects of content policies have not standardized teacher practice (e.g., Schmidt, Porter, Floden, Freeman, & Schwille, in press). Perhaps because the content policies are not as prescriptive as they might be, or strong in other ways, teachers interpret policies differently. For example, in one district with a management-by-objectives system for elementary school mathematics, one teacher used the system to individualize mathematics during one period of the day but also taught mathematics during an additional period using a different textbook and whole group instruction. Another teacher used the system as a template for deciding what to teach, when, and to what standards of achievement to each of his students, allowing students to leave the system only after they completed objectives well beyond their current grade level. Yet a third teacher only referred to the district objectives occasionally when planning instruction (Porter & Kuhs, 1982).

In another district that had recently adopted a new textbook, one teacher followed the book page by page, recognizing that the desired effect of a standardized curriculum in the district would be achieved only by following the book closely. Another teacher, not recognizing the motivation behind the single text adoption, followed her own strong convictions about what content should be taught and when, using the text only as a resource for student exercises that fit her own internal syllabus (Freeman & Schmidt, 1982).

Textbooks and Tests as Special Cases

One of the myths exposed through work on teacher content decision making is that teachers teach the content in their textbook (Porter, 1985). Elementary school teachers view mathematics textbooks as resources to be drawn from and to be added to as seems appropriate (this belief remains unchallenged even when the textbook is mandated). Further, because textbooks do not address several of the most important content decisions, their influence is limited primarily to topic selection. Textbooks contain few instructions about how much time should be allocated to mathematics or about differences among students concerning what should be taught; they offer ambiguous advice about standards to which students should be held. Even in topic selection, most teachers cover only a fraction of their textbook's content (e.g., Freeman, 1983) and spend 10% to 20% of mathematics instruction time covering topics not in the book.

Another myth exposed as being only a half truth is that teachers teach topics that are tested. Little evidence exists to support the supposition that national norm-referenced, standardized tests administered once a year have any important influence on teachers' content decisions. There are, however, important effects from curriculum-embedded tests (e.g., tests tied to objectives in a management-by-objectives system, chapter tests in a textbook, tests developed by teachers to help make placement decisions). Tests have effects on content decisions only when they have been explicitly tied to the curriculum and when they are readily accessible and easily used by teachers (Kuhs et al., 1985).

Student Effects

Teachers' content decisions are also influenced by students and students' parents. Sometimes the effects are direct, coming in the form of requests to cover specific topics or requests for more homework. More often the effects are indirect, coming in the form of expectations. Student and parent effects are not random; they correlate in important ways to student characteristics such as aptitude, gender, and ethnicity.

When mathematics is taught to ability groups or to individuals, within-class content differences are dramatic. Primarily these differences concern the topics of study, rather than the total amount of time spent or the standards to which students are held. Low-ability students spend far more time learning facts and computational skills whereas students of higher ability spend more time understanding mathematical concepts and applications. High-ability students cover more topics and spend less time per topic than do low-ability students (Irwin et al., 1985).

Individualized instruction shows some evidence of gender effects. Girls encounter a larger number of topics whereas boys study fewer topics for more time. Boys study topics that involve more conceptual understanding, more applications and more work with pictures. Some evidence suggests an interaction between perceived ability and ethnicity. Regardless of beginning achievement scores, black girls study fewer topics than do other students, including fewer topics related to conceptual understanding and applications (Irwin et al., 1986a).

Whole-group instruction, however, is the primary method used to teach elementary school mathematics, minimizing differences in content among students within classrooms. Further, for a given teacher, the effects of differences among groups of students across years appear to be minimal. Even when a class is judged by the teacher to be unusually good or unusually "slow," modifications to accommodate those differences are slight. The large effects of students on teacher content decision making take place at the aggregate level. The socioeconomic status (SES) of the school student body correlates with the degree of parental influence on content, the instructional resources available to teachers, the amount of time spent on mathematics, and the topics covered (Irwin et al., 1986b). In affluent neighborhoods, parents are seen as a legitimate source of advice, generally concerned with what their children are taught. In schools that serve working class or unemployed families, parents are viewed as uninterested in particular content, even lacking the understanding required to help their children. Lower SES schools have fewer resources available for mathematics instruction. Lack of rulers and protractors affects work in measurement and geometry, and limited textbook availability affects the frequency of homework assignments. High SES schools spend less time on mathematics but cover more topics than do lower SES schools. Lower SES schools emphasize more computation and less application and concept instruction.

The correlations between the content of instruction and student characteristics are problematic. There is a tension between the amount of time students need to master content and the range of content they can cover. If understanding mathematical concepts and applications is important, however, then all students deserve an opportunity to study that content. Schools and teachers must be attentive to and must manage the dilemma to provide time for mastery as they assure access to useful content.

The Case of the Missing Principal

In this summary of content determinants research, policies are featured because of their surprisingly strong effects and because the number and strength of content policies is increasing at both state and district levels. Principals are featured for the opposite reasons. Despite literature emphasizing the importance of principals in school leadership and the adoption of innovations, principals are not a major influence on teachers' decisions about what to teach in elementary school mathematics.

The literature on principal leadership and this conclusion about content decision making are not necessarily contradictory. On the rare occasions when principals have attempted to exert influences on content, teachers have accepted the attempts as legitimate and the influence of those attempts was felt in classroom practices. But most principals remain silent on content preferences, leaving content decision making to their teachers at the classroom level and to policymakers at higher levels. Even more surprising, principals show little interest in ensuring that teachers carry out district policies. Many principals have little knowledge of district policies, devoting their efforts instead to such noncontent areas as student discipline and attendance (Floden et al., 1984).

Teacher Convictions

Differences among teachers in the content of their elementary school mathematics instruction are more substantial than can be attributed wholly to differences in policies, students, principals, or other external factors. For example, teachers at the same grade level have been found to differ in their allocation of time to mathematics by a factor of 1.5 (9000 minutes versus 6000 minutes across a full school year). Of similar magnitude, differences among teachers exist concerning the average amount of time per topic. Teachers agree in their emphasis on computational skills over concepts or applications, but within that emphasis, percentage of time devoted to computational skills ranges from a low of 55% to a high of 80%. At the level of specific topics, the differences among teachers are too many to summarize. Some of these differences may even out over years for students, but students with a teacher who fails to cover geometry or who gives little attention to estimation or measurement applications are unlikely to have those omissions compensated for by other teachers in later grades.

Differences among teachers in the content of their elementary school mathematics instruction are partially a function of differences in convictions about mathematics. Teachers differ in their knowledge of mathematics, in their interest and enjoyment in teaching mathematics, in their beliefs about the importance of mathematics and the most important topics within mathematics, and in their expectations for what students can accomplish. But just as content policies have been judged to be relatively weak, elementary school teachers' convictions about mathematics are also weak. Elementary school teachers are reluctant to take responsibility for content decisions and often appear unaware that they do indeed make mathematics content decisions. During interviews, teachers often said that no one had ever asked about their mathematics content before. When asked to keep content logs, many teachers expressed keen interest in the results and some planned to monitor their own instruction in future years. Clearly, most elementary school teachers do not spend much time analyzing the appropriateness of the content of their mathematics instruction. Their positions on content remain largely unexamined, by them or by anybody else.

A few elementary school teachers do hold strong convictions about mathematics, looking primarily to their own beliefs to decide the content of their instruction. But these teachers are in a distinct minority. Curiously, they are not necessarily the teachers who possess the greatest subject matter knowledge (Freeman, 1986).

Generally, elementary school teachers are willing to change their mathematics content if (a) they view the change as being not too difficult, (b) what they are asked to do is within their range of knowledge, and (c) the request adds new content and does not give up content they have been teaching (a point given more attention later). In the case of textbook adoptions, teachers' willingness to try new content takes an unusual twist. Teachers tend to follow a textbook most closely during the initial year of use. Once they have become familiar with a textbook and know what it has to offer, teachers feel greater freedom to make adjustments and introduce some of their own preferences. The inclination to drift away from the book over time might be offset by policies that specify how teachers are to use their texts, but such policies rarely exist.

Some Thoughts on the Curriculum

Research on teacher content decision making in elementary school mathematics has not sought to evaluate the quality of the curriculum. Nevertheless, certain features stand out, virtually demanding comment. A ubiquitous and pronounced lack of balance exists across concepts, skills and applications. Teachers spend a large amount of their mathematics time teaching computational skills--approximately 75%. The remaining time is distributed between teaching for conceptual understanding and applications in ways that vary from teacher to teacher. Most textbooks and minimum competency or basic skills objectives emphasize computation; however, nationally normed standardized achievement tests have balance across conceptual understanding, applications, and computational skills (Freeman, Belli, et al., 1983). The lack of balance in teacher attention to conceptual understanding, skills, and applications is problematic and should be addressed. Applications are both more important and more difficult to learn than are skills. Conceptual understanding is probably of more lasting value than either skills or applications. By formulating policies that are prescriptive, consistent, and carefully tied to sources of authority, it should be possible to create a more balanced curriculum.

A second feature of the elementary school mathematics curriculum is related to the first. Just as teachers devote a great deal of time to a relatively few computational skills, they tend to cover a large number of topics in the small amount of remaining time.

Seventy to eighty percent of the topics taught during a school year receive 30 minutes or less of instruction. Many of these topics are "touched on" or "taught for exposure," receiving only 5 or 10 minutes of attention during the year. In part, this phenomenon may be explained by a similar pattern of topic coverage in textbook exercises. The practice of covering many topics, each for a little time, also may be a function of teachers' greater willingness to take on new topics in their instruction than to give up topics they have been teaching. Whatever the reasons, the elementary school mathematics curriculum is thin and appears to be getting thinner. The practice of teaching for exposure raises questions about how much instructional time on a topic is enough. Are students learning that mathematics includes a wealth of interesting topics or are they learning that superficial knowledge (knowing just a little about a lot of different things) is somehow valuable?

A third feature of the elementary school mathematics curriculum concerns what is missing. Students are rarely, if ever, asked to formulate a problem for themselves. Instead they are given problems to solve. Mathematics receives little attention as a discipline worth knowing in its own right in addition to being a basic skill with utilitarian value. Even the utilitarian aspects of mathematics receive too little serious attention. For example, young women's and minorities' lack of valuing of mathematics is not sufficiently challenged by information about the mathematics prerequisite to qualify for later study and for many job possibilities.

Finally, although the elementary school mathematics curriculum is second in importance only to reading and language arts, it is treated as a distant second. Only a small amount of time is allocated to mathematics instruction. A few classrooms spend an hour or so a day on mathematics, but most classrooms average much less; some average as little as 20 minutes. Teacher choice seems to be an important determinant of the amount of classroom time spent on mathematics and low averages may reflect teachers' dislike of math (e.g., Buchmann & Schmidt, 1981).

Summary

Until recently, educational research has focused attention on the strategies of instruction. Content received little attention. By distinguishing between strategy and content and by focusing on content, a great deal has been learned about teaching practices and about the interaction between educational policies (and other external factors) and teachers' convictions. The following commonly held beliefs have been challenged:

- There is a national curriculum in elementary school mathematics.
- From the perspective of content covered, materials are interchangeable.
- What is taught in one classroom closely resembles what is taught in another classroom at the same grade level.
- Textbooks determine the content of instruction.
- Teachers are resistant to top-down calls for change in matters of content.
- Policies have their effect through the manipulation of rewards and sanctions.
- Teacher autonomy is better than central control.
- Individualized instruction is better than group instruction.
- Instruction is better when teachers make substantial deviations from commercially prepared materials.

Partly as a result of research on content determinants, publishers of instructional materials are now much more aware of and concerned about curricular validity. Similarly, schools are more concerned about issues of curriculum alignment. Those responsible for monitoring education are more aware of the need to monitor the content of instruction as well as other aspects of educational inputs, processes, and outputs (e.g., the framework for describing elementary school mathematics has served as input to the National Research Council's Committee on Indicators of Precollege Science and Mathematics Education and is under consideration by the Center for Educational Assessment of the Council of Chief State School Officers). Teacher education programs are beginning to address the teacher's role in content decision making, an aspect of the teacher education curriculum that was largely missing. Educational research, especially research on teaching, now recognizes the importance of differences among teachers in their emphases on academic content. Increasingly, research studies focus on content decision making and the ways teachers make use of instructional materials.

Work on content policies and their effect is more recent and less visible. Nevertheless, the work points to a middle ground between two developments which seem on a collision course. On the one hand, centralized control of the curriculum is increasing. States and districts are developing policies which specify what is to be taught, to whom, and to what standards of achievement. On the other hand, there is increasing concern for the status of the teaching profession. Recommendations are for greater teacher autonomy and greater teacher participation in school policy formulation. But central control versus teacher autonomy may be a false dichotomy. Content policies will be persuasive to teachers if teachers are meaningfully involved in establishing those policies. Under those conditions, compliance and professional autonomy become two sides of the same coin.

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TEACHER EXPLANATION

The Teacher Explanation Project was designed to determine if teachers who are more explicit in explaining reading skills as strategies produce low-group students who are more aware and who achieve better. Four studies have been conducted, two that were descriptive and two that were experimental. The results of these analyses indicate that (a) teachers who are more explicit in explaining skills as strategies are more successful in creating both student awareness and achievement growth than teachers who are less explicit and (b) the process of learning to become explicit is a difficult one necessitating conceptual change and sophisticated interactive decision making.

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TEACHER EXPLANATION

The Teacher Explanation Project was based on the hypothesis that the most effective teachers are those who are most explicit in verbally explaining to students how the reading process works. Such explicit instructional talk makes students conscious of the strategic nature of reading which, in turn, puts them in control of the reading act so they can achieve better. Consequently, the basic research question was as follows:

> Are low-group students of classroom teachers who are explicit in explaining how reading works more aware and better readers than low group student taught by teachers who are less explicit?

The concept of "teacher explicitness" was crucially important. It was operationally defined by a rating form that was used to score lesson transcripts. The criteria for teacher explicitness included what the teacher said (about the strategy being taught, how it would be useful, how to select it and the mental processing employed when doing it), the way the teacher explained (the organization of a lesson including the introduction, the presentation, the teacher-student interaction, and the closure), and the cohesion (both intralesson and interlesson cohesion).

This line of research is distinct from other reading instructional research in six ways. First, the student outcome is metacognitive control of the skills of reading, with skills being seen as language conventions that expert readers use strategically and flexibly to get meaning from text. The good reader's "executive control" is due in part to an ability to think consciously about how to use reading skills as strategies to remove meaning blockages as they occur, and instruction is perceived as the process of providing students with explicit knowledge about this mental processing so that it can be activated during real reading (Roehler, Duffy, & Meloth, 1986). Second, because the focus was metacognitive use of skills, the outcome measure was not simply students' achievement but also students' awareness. Third, "instruction" was imbedded in the teacher's verbal explanation of how to do something that students do not now know how to do (in this case, how to do the mental processing associated with using skills as problem-solving strategies) (see Duffy, Roehler, Meloth, & Vavrus, in press).

Fourth, because low-group students have more difficulty inferring how reading works than the high-group students, it was assumed that explicit explanations are needed more by low-group students and, as a result, only low-group students were studied. Fifth, the setting was the natural classroom with all its normal constraints, including existing grouping patterns, the accountability system, the mandated instructional materials, the allocated instructional time, and the abilities and beliefs of the participating teachers. Finally, we avoided the use of scripts but, instead, taught teachers how to plan and teach their own lessons. In a sense, we taught teachers to be strategic and metacognitive about their instruction in the same way that we wanted them to teach their students to be strategic and metacognitive about getting meaning from text.

The Line of Studies

The Teacher Explanation Project was initiated in 1981. Four studies, each a year long, were conducted. The same basic procedures were used in each of the four studies. We recruited real classroom teachers, provided training and coaching designed to teach them how to explain the mental processing associated with using skills as strategies, and observed them for one academic year in the natural environment of their classrooms. During each observation, the teacher's lesson for the low group was audiotaped, the classroom management was rated, and field notes were made. Following each observation, five randomly selected students from the observed low reading group were individually interviewed about what they learned, when they would use it, and how to do it. Students' scores on various traditional and nontraditional achievement measures were collected and analyzed on a pre- posttest basis. Summaries of the four studies follow.

Year One

The research began in 1981-82 with a pilot study of four second-grade teachers and their low reading groups (Duffy, Roehler, Book, & Wesselman, 1983; Duffy, Roehler, & Book, 1983; Roehler & Duffy, 1984). The four teachers received five individual help sessions and were observed six times. Results indicated that, of the four teachers, one consistently received high explanation ratings, one improved throughout the study, one made no real change, and one was unable to use explanation techniques because of management problems. The student awareness ratings showed a strong positive relationship to explicit teacher explanation, and pre- and postmeasures, using the comprehension subtest of the Woodcock Reading Mastery Test, suggested a relationship between explicit teacher explanation and achievement. Descriptive findings suggested three qualitative characteristics of the most effective explanations: (a) skills should be taught prior to the reading of the basal selection, rather than following the selection as is the case in the standard basal textbook lesson; (b) an explanation should contain verbal statements that specify what the skill helps the reader do, when the skill is useful, and how to do it; (c) once skills are explained, they should be applied in the basal selection.

The pilot study results seemed to support the hypothesis that teacher effectiveness is associated with explicit teacher explanations. Given this support, an experimental study was conducted during 1982-83.

Year Two

The 1982-83 study focused on experimentally linking teacher explanation with student awareness and student achievement (Duffy, Roehler, Meloth, Vavrus, Book, et al., 1986). Twenty-two fifth-grade teachers participated. Based on ratings of their classroom management, teachers were stratified and randomly assigned to treatment or control groups. The treatment teachers received six two-hour sessions in how to explain the use of reading skills whereas the control group received a two-hour session on reading management techniques. Each treatment and control teacher was observed five times at one-month intervals between November and April. All observations occurred in the natural classroom setting, every teacher used standard basal textbook materials, and each lesson focused on whatever reading skill the teacher had planned to teach on that day. The achievement measure was the Gates-McGinitie Reading Achievement Test.

Results indicated that treatment teachers were significantly more explicit in their explanations than control teachers and that the low-group students of the explicit teachers demonstrated more awareness than the low-group students of less explicit teachers. Achievement growth, however, was not significantly different for the treatment group than for the control group. Qualitative analysis indicated that (a) the teacher's interactive role in providing spontaneous elaborations and reexplanations after assessing students' restructuring of the initial explanation was crucial to effectiveness, (b) teachers who present the skill in the context of its immediate usefulness in the selection to be read have greater success than teachers who delay talk about the skill's usefulness until after the initial explanation and (c) teacher talk which establishes cohesion within and between lessons is important in getting students to monitor their own comprehension routinely.

The absence of achievement gains was attributed to three conditions. First, treatment teachers indicated that the complexities of the classroom and the pressures of instructional mandates from the school districts made it difficult for them to incorporate explanation techniques into their instructional routine.

Second, many of these teachers reported that, because of the above difficulties, they employed explanation techniques only when they were observed. Third, the use of the Gates-McGinitie test as the sole achievement measure may have masked growth in strategic reading because standardized tests tend to be sensitive to aptitude more than to specific growth in using skills as strategies. A third study was designed to develop a richer description of explanation, better ways to intervene with teachers, and a broader range of achievement measures.

Year Three

The 1983-84 study was descriptive (Roehler, Duffy, Putnam, et. al., 1986). Seven teachers from the previous year's study (three from the experimental group and four from the control group) agreed to participate. The previous year's general design was used, with teacher explanation, student awareness and student achievement being measured. As in 1982-83, the results indicated significant growth in teacher explanation and in student awareness, but no statistically significant gains in achievement, although there were trends favoring the most explicit teachers. Additional achievement measures to supplement standardized tests were developed and field tested, and a refined staff development model that helped teachers implement explanation techniques despite the constraints of routine basal text instruction was evaluated.

Year Four

Based on the 1983-84 results, an experimental study of twenty third-grade teachers and their low reading groups was conducted in 1984-85 (Roehler, Duffy, Wesselman, et. al., in press). Teachers were randomly assigned to either a treatment group receiving training in explicit explanation or to a treated control group emphasizing the reading management techniques from the First-Grade Reading Group Study (Anderson, Evertson, & Brophy, 1979). Pre-posttest measures were obtained for the instructional explicitness of the teachers in both groups, for the awareness of five students from each of the 20 classrooms, for achievement on the Stanford Achievement Test, for the response of three target students in each classroom to a graded reading oral paragraph test designed to assess strategic use of skills and to a self-perception measure. A global measure of students' concepts of reading was administered at midyear and again at the end of the year. The intervention with the treatment teachers consisted of six two-hour sessions and included the viewing of videotapes of explanation lessons, discussions of assigned reading, collaborative learning activities, and individual coaching sessions. The teachers in the treated control group received the intervention provided in the original First-Grade Reading Group Study. All teachers in both groups were observed at one-month intervals throughout the academic year. During the year, data were collected regarding each teacher's explanation, their low-group students' awareness immediately following the observed lessons, criterion tests of the skills taught and students' reasoning about the use of these skills. Gain scores for each of the various awareness and achievement measures for students in the treatment group were compared with those in the treated control group. Additionally, comparisons were made between the performance of treatment and treated control students on the Michigan Educational Assessment Program, which was administered in October of the year following the study. The results indicate that treatment teachers were more explicit than their treated control counterparts in explaining the mental processing associated with skill use, that students of treatment teachers were more aware of both lesson content and of the general need to be strategic than the treated control students, and that treatment students achieved better than the treated control students, both in terms of traditional achievement test measures and in terms of less traditional measures of students' reasoning while using skills as strategies.

Discussion of the Implications of This Line of Research

Major Implications

The Teacher Explanation Project documents the importance, during low-group reading instruction, of explicit teacher explanations of the mental processing associated with cognitive tasks. Two major implications emerge.

First, explanation of mental processes is established as a component of instruction. This is important because explanation of mental processes is not emphasized in recent instructional research generally (see Brophy & Good, 1986; Rosenshine, 1986) or in reading instructional research particularly (see Au, 1979; Palincsar &

Brown, 1984; Paris, Cross, & Lipson, 1984; Pearson, 1985). In fact, reading researchers such as Tierney and Cunningham (1984) suggest that explaining mental processes may be "fraught with danger." This study suggests that such fears are groundless, that mental acts can be explained, and that such explanations result in better student outcomes than when a teacher employs the more common practice of doing a cognitive task as students watch, then coaxing them to do the same thing, and then assessing to determine whether or not they did it.

The second implication focuses on the student's role in instruction. By focusing on student awareness as well as achievement, the study highlights the student's role as a mediator of instructional information and suggests that this mediational process takes time. Students do not immediately absorb instructional information. Instead, they restructure the information on the basis of past experiences and their goals in the instructional setting. Gradually, as teachers present explanations across the academic year, students modify their understandings in the ways intended by the teacher (Duffy & Roehler, 1986).

This gradual development was evident in the results of the 1984-85 study in which the awareness scores of treatment students gradually increased over the academic year. This increasing awareness, in turn, was associated with the explicitness of the teacher's explanations. The more consistent the teacher is in providing explicit explanations throughout the academic year, the more likely it is that students will mediate instructional information accurately and, ultimately, achieve the intended goal. In sum, the combination of the student's mediational role and the effects of explicit teacher explanations suggests a model for instruction (Duffy, Roehler, Meloth & Vavrus, in press). This model states that the most efficient way to instruct is to provide instructional information as explicitly as possible to increase the possibility that the students will understand what is intended by the teacher, with a causal relationship possibly existing between the teacher's explanation and the degree of student awareness and between student awareness and student achievement. In short, the better the explanation, the greater the awareness; the greater the awareness, the better the achievement.

Additional Implications

In addition to the major implications noted above, the results from the Teacher Explanation Project suggest three other implications: implications regarding the nature of explanation, implications regarding the complexity of cognitive learning, and methodological implications.

The nature of explanation. Explanation is usually conceptualized as modeling; the explanation is often thought to be over when the modeling ends. This study suggests that this view of explanation is too narrow. The best explainers continue explanations throughout the lesson, elaborating on the lesson content in response to the restructured understandings students develop as they mediate what the teacher says (Duffy & Roehler, 1986; Duffy, Roehler, Meloth, & Vavrus, in press). Those teachers who continue explanations beyond modeling by responsively elaborating on students' restructured understandings are more effective than teachers who simply provide explicit models. Consequently, an important implication of this study is that it broadens the traditional definition of explanation, suggesting that simply "front-loading" lessons with an explicit model is not enough.

Cognitive learning. Regarding cognitive learning, this study documents its complexity in two ways. First, low-group third-grade students do not immediately respond to instruction on cognitive tasks. For instance, in the 1984-85 study, it took until Observation Four to achieve significant differences in treatment students' awareness of the mental processes associated with using skills as strategies, despite very explicit instruction in Observations Two and Three. Instead of immediate awareness, there was a gradually increasing awareness over the course of the academic year. This suggests that, when instruction designed to develop cognitive outcomes such as those associated with this project is consistent and continuous, low-group third-grade students gradually develop the desired understandings.

Second, traditional achievement measures, when used alone, are generally inadequate for measuring congitive outcomes such as strategic employment of reading skills. While the two traditional standardized achievement measures employed in the 1984-85 study resulted in significant growth favoring treatment students, the nontraditional measures provided the most direct evidence of students' metacognitive awareness of reading strategies and of their cognitive processing when using strategies. Consequently, while short studies and traditional paper-and-pencil measures may be adequate in instructional studies where the outcomes emphasize memory rather than reflection, the complexity of cognitive learning demands that the design of instructional studies which deal with these outcomes be longer and include nontraditional measures of performance.

Methodological implications. Finally, this study suggests three methodological implications. First, it is a strong argument for naturalistic research that is conducted in actual classrooms where the constraints of teaching influence the instructional innovation. In any other setting, one never knows whether the innovation can be implemented by real teachers or not. Second, as noted earlier, instructional research should be longitudinal, especially when the desired outcomes are cognitive understandings, because studies of less than an academic year in duration are less likely to capture the changes in students' strategy use. Finally, staff development is crucial in instructional studies where the innovation being studied involves more than proceduralized instructional routines. When the intervention focuses on major kinds of decision making such as those required of the teachers in this study, a carefully constructed staff development model is necessary to ensure that teachers change their instructional behavior enough to foster differences in student outcomes. For a detailed discussion of the staff development implications, see Putnam, Roehler and Duffy (in press).

Future Directions

While the findings of the Teacher Explanation Project are relatively conclusive, there are nevertheless five new questions about instruction which this project generated.

First, because of the gradual way in which students' understandings developed in this project, a longitudinal study of the impact of teacher explanation is needed. The data suggest that the effects of consistent and explicit explanations about the mental processes involved in using skills as strategies would be even more effective if students received such instruction for longer than one academic year.

Second, as important as explicitness about mental processing apparently is, the descriptive data from this project suggest that it is not enough to simply be explicit. Instead, there are qualitative dimensions to the instructional interactions that occur during explanations which cause instruction to be more or less effective (Duffy, Roehler, & Rackliffe, in press). Additional studies must be conducted to identify these qualitative dimensions and, ultimately, to test them in experimental studies.

Third, techniques for measuring outcomes associated with strategic reading must be further refined for use in future instructional studies. While the measures of student awareness and student cognitive processing used in this study effectively discriminated between treatment and treated control students, improvements in each of these measures are needed. Recommendations regarding these changes are provided elsewhere (Duffy, Roehler, Meloth, Polin, et al., in press).

Fifth, more descriptive work needs to be done regarding what to say to students about the cognitive processing one does when applying skills strategically. Little information is available regarding the universal features of such reasoning or whether the idiosyncratic nature of cognitive processing precludes any universal features. Consequently, there is currently little of a specific nature that can be confidently included in explanations about mental processing. More study of the qualitative dimensions of teacher's descriptions would help alleviate this problem.

Finally, interview data from participating teachers suggest that there is wide variation in teachers' abilities to conceptualize both reading as a strategic process and teaching as the provision of substantive explanatory information (Duffy & Roehler, 1985; Duffy, Roehler, & Putnam, in press). Further, these data suggest that teachers' conceptions about reading and instruction have an impact on their effectiveness in creating student outcomes. This relationship needs to be explored more fully in future studies.

Conclusions

The Teacher Explanation Project is important for two major reasons. One is instructional; the other is methodological. Instructionally, it establishes the importance of explaining mental operations. Teachers who explicitly explain the mental acts involved in using skills strategically have more success with low-group students. Consequently, explanation of mental processing is a component of instruction which must be carefully developed and consciously employed. Methodologically, this study establishes the potential for studying instruction in natural settings. Instead of conducting instructional studies using (a) a researcher as the teacher, (b) an adjunct curriculum and/or (c) limited lengths of time, this study conducted instructional research using regular classroom teachers and the mandated curriculum for the entire academic year. While such naturalistic experiments are difficult and costly, their ecological soundness adds a unique dimension of validity to the results.

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WRITTEN LITERACY FORUM

Since 1977, researchers at the Institute for Research (IRT) on Teaching have engaged in studies of the teaching and learning of writing. These studies have involved an interdisciplinary research staff and collaborating teachers from elementary, middle and high schools. In 1979, we were awarded an NIE grant to conduct field work research in an elementary and a middle school classroom. This study combined methods from cognitive psychology and the ethnography of communication to study teacher planning and the social contexts of writing instruction. The four teachers involved in the study were active throughout providing research data and helping to shape the direction of data analysis.

The current Written Literacy Forum grew out of this association between teachers and researchers. Since its establishment in September 1981, the Forum has involved 8 to 10 teachers and researchers working together to bring research on writing into practice in the classroom. Forum deliberations have addressed the following questions: What are the current problems and challenges of writing instruction in our schools? Why is writing difficult to teach? What roles do teachers play in supporting writing development among their students? What is the nature of teachers' response to their students' writing? How can microcomputers become part of the writing classroom?

In the past three years Forum participants have organized literature reviews, conceptual papers, and teacher/researcher retreats to address these questions. Looking back over our project's history, three themes emerge as central to the work: (a) the relationship between scientific knowledge and practical action, (b) the ways in which teachers think about school writing, and (c) the nature of public schools as environments for teaching and doing expository and creative writing.

Christopher M. Clark and Susan Florio-Ruane (coordinators)
Saundra Dunn

WRITTEN LITERACY FORUM

Introduction

"Why is it so difficult to teach writing?" This enduring practical problem guided the work of the Written Literacy Forum for the past five years. Trying to help teachers answer this question, the Forum has been a source of knowledge about three related issues: (a) the relationship between scientific knowledge and practical action; (b) the cognitive process and other behaviors that teachers engage in while planning, implementing, and revising writing curricula; and (c) the nature of public schools as environments for teaching and doing expository and creative writing.

The first of these issues lies at the root of the problem of bringing knowledge generated by research into practice in ways that improve teaching and learning. The second issue concerns a central mission of the IRT: describing ways in which teacher thinking, planning, and decision making affect what is taught and how it is taught. The third issue addresses the difficulty of teaching writing by documenting how the social, temporal, intellectual, and institutional aspects of schooling affect teachers and students.

A fundamental assumption of the Written Literacy Forum is that improvements in the quality of written literacy education come from the actions of educators who appreciate the cognitive and emotional demands of writing and who understand ways in which the context of schooling can limit or enable its teaching and learning. Working with a group of experienced teachers in the Forum gave IRT researchers an opportunity to share theory with practitioners and use their questions and insights to help frame meaningful studies of the teaching of writing.

The final progress report of the Written Literacy Forum has two parts. First, the report summarizes the work of the Forum on the three related issues of (a) theory into practice, (b) schools and classrooms as contexts for writing instruction, (c) teacher thinking about writing. Second, the report provides an annotated bibliography of articles, reports, papers, and book chapters published by the members of the Written Literacy Forum on these three topics.

Summary of Forum Insights and Accomplishments

Relating Research to the Practice of Teaching

One of the central purposes of the Written Literacy Forum was to learn about and experiment with ways of bringing together research and the practice of teaching. For us as researchers this has been an educative and humbling experience. As we came to see the teaching of writing from the perspectives of Forum teachers, we realized that research and theory play only modest roles in improving and sustaining good practice. These modest contributions are certainly worth pursuing. But this lesson in humility changed the way in which we thought about the "research into practice" problem. Our original framing of the issue was both idealistic and conventional:

> A great deal of high-quality research and theorizing about the teaching of writing has been done and published; however, it is published in forms and places inaccessible to practicing teachers. What can we (researchers) do to make this knowledge available to teachers in ways that they will find directly useful in reforming and improving their own teaching and writing?

This paraphrase of the original Forum mission statement casts our work as that of solving a subject matter specific dissemination problem. It entails a number of assumptions that now, five years later, appear to be unsupported. First, it assumes that there is a large well-developed body of research literature on school writing.

Second, the mission statement implies that researchers are in the best position to interpret published literature and to accomodate it to the practitioner audience (typically seen as a single audience with common language, problems and concerns).

Third, it implies that knowledge and information are the most important fruits of research and theorizing in terms of solving problems of practice. Furthermore, the mission statement implies that there is a high degree of transfer value and applicability of research knowledge developed in one particular setting to other particular settings.

Fourth, it implies that there is a readiness on the part of at least some teachers to change their ways of teaching writing, if only research would convincingly show the way. A related assumption is that teachers frame at least some of their problems of practice as "well defined problems with my teaching of writing, for which there is a solution presently unknown to me but probably known to some researchers."

Our experiences in the Forum indicate that these assumptions are flawed in at least the following ways: First, while there is a literature of research on writing (see, for example, the Scardamalia & Bereiter, 1986, review) much of the research does not include or address the important constraints and realities of writing in school classrooms.

Second, researchers do have something to offer by way of interpretation of the literature, but we know relatively little of our multiple teacher audiences, their background knowledge, concerns, motives, and languages. Here, we need considerable help from teachers in making sensible, audience-sensitive interpretations.

Third, we have discovered that teachers have little direct use for knowledge and information that is decontextualized and generalized from studies done in settings different from their own classrooms.

Fourth, we believe that even good teachers are not eager to make dramatic and labor-intensive changes in their ways of teaching writing and they are not looking to the research community for solutions to well-defined problems of practice. The "big problems" of school writing are not well defined, and they are inextricably bound up in a whole complex of issues: contextual, curricular, professional roles, student expectations and abilities, teachers' general feelings of efficatiousness and particular competence as writers, and teachers' understandings and acceptance of the limits of professional responsibility.

Schools and Classrooms As Contexts for Writing Instruction

Out of five years of reading, writing, and researching with educators, we have developed a clearer understanding of the phenomenon of "school writing." Writing is not a private mental process that can be parsed into a series of inevitable steps. Writing is a set of tools for communication available to the members of a culture. Learning to write depends on cultural membership and participation in institutions where writing is defined and used. In our culture, the school is the institution most responsible for teaching writing to the young. The history, social functions, and normative order of schools are powerful forces shaping the writing that is taught and learned there.

Schools define the range and types of writing students will learn. Schools also determine the purpose to which writing is put. Students are socialized to write accordingly. Some types and purposes of writing taught in school are available to be learned nowhere else in the culture. Others foreshadow the writing students will do when they enter the adult world of work. Some forms and functions of writing learned by children outside school may not be recognized or valued in a student's school experience.

The teacher's role is largely set by the history and social organization of schooling in our society. The teacher has the right and responsibility to communicate the standards to which students will be held when they write and to assess students' progress in achieving them. In addition, teachers are responsible for planning writing tasks for students. Teachers are initiators and audience/evaluators for most school writing done across the grades and across subject areas.

Although the nature of the teacher's rights and duties is largely predetermined, how teachers actually carry out their work is moderated by their knowledge, beliefs, and attitudes. We know a great deal about how teachers shape and color what happens in classrooms as a function of their implicit theories about (a) how to teach, (b) what schools are for, and (c) how children grow and learn. The Written Literacy Forum has illuminated some of the ways teachers' knowledge and beliefs about writing shape that part of the curriculum.

Students enter the classroom already having learned a great deal about how to act, communicate, or organize themselves to learn. Their background knowledge comes from the family, neighborhood, peer group, previous school experiences, and wider forces in the culture such as books, television, and commercial products. Although teachers are delegated the authority to organize the learning environment, teachers and students work together to create classroom life and communication. The participatory nature of classrooms is both a resource and potential source of conflict in the language curriculum. Forum research illuminated some of the ways that teachers and students negotiate the forms and functions of writing.

Figure 1 is a model of many of the social and intellectual factors operating when teachers and students come together to study writing. At the center, and most visible to participants and analysts, is the teaching/learning encounter. In Figure 1 that encounter is the "writing conference" or meeting in which teacher and student(s) communicate about a written draft. (The encounter might also be a lesson, test, laboratory experience, or other school task.) The conference is the setting in which propositional, procedural, and normative knowledge about writing are communicated. It is the place where teachers teach and learners learn about writing in the most explicit and direct way. Because of its ubiquity and importance in writing instruction, the members of the Forum devoted a great deal of time and effort in the past five years to understanding what occurs when teacher and student meet to talk about text.

Despite the centrality of the writing conference in instruction, Forum research found that teachers' and students' talk about text is not reducible to a discrete set of topics or techniques. What occurs when teacher and student(s) meet in writing instruction is shaped by a myriad of contextual factors. Figure 1 includes among those factors teachers' prior knowledge and beliefs about

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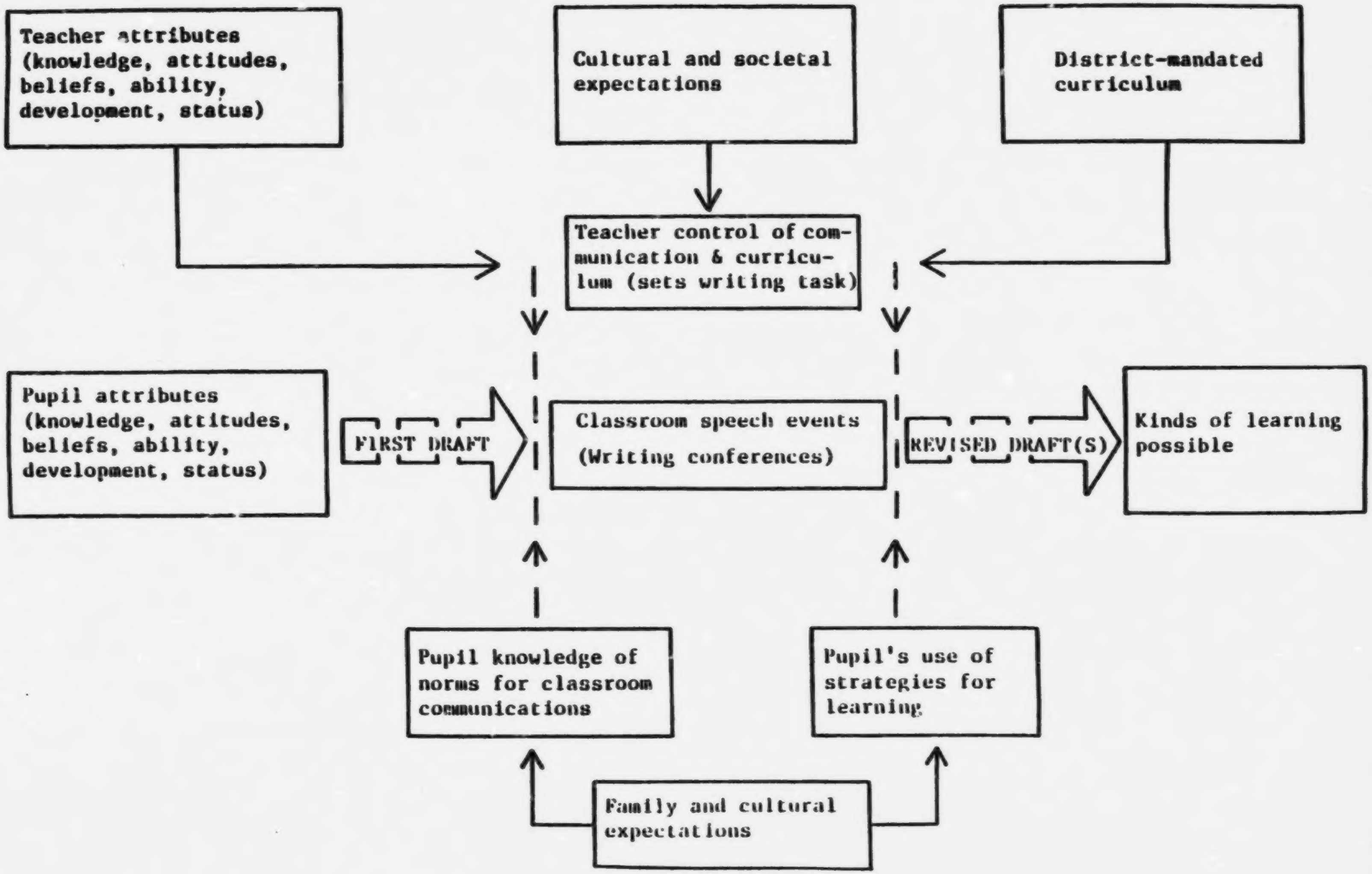
Teacher attributes (knowledge, attitudes, beliefs, ability, development, status)
Cultural and societal expectations
District-mandated curriculum
Teacher control of communication & curriculum (sets writing task)
Pupil attributes (knowledge, attitudes, beliefs, ability, development, status)
FIRST DRAFT
Classroom speech events (Writing conferences)
REVISED DRAFT(S)
Kinds of learning possible
Pupil knowledge of norms for classroom communications
Pupil's use of strategies for learning
Family and cultural expectations

Figure 1. Model of the writing conference as instructional conversation.

writing and how it is taught and learned, students' background experiences that shape their understanding of writing and of appropriate ways to communicate in school, and school and district policies that influence classroom communication in many ways. Assessment, curricular requirements, materials, inservice education, and limits on time and space are among the contextual factors from outside the classroom shaping what occurs when teachers and students meet. And, since schools exist to serve and perpetuate state, community, and national values (both transitory and historical), these also shape the writing that is done in classrooms.

Until the last few years, writing, though valued, was relatively invisible in the school curriculum or in the curriculum for teacher education. Moreover, writing was not accorded "regular subject matter status." Few districts had explicit writing curricula, there were few published materials available for teaching writing, and time in the school day was not regularly provided for writing instruction. Working under these limitations, teachers claim that writing instruction in their classrooms tends to have an ad hoc quality with no clear and coherent set of curricular goals, few meaningful activities, and no theory of instruction connected to writing growth and development.

The convergence of intellectual and social factors on the teaching/learning encounter is an appropriate topic for research on writing instruction. Many factors shape classroom communication both orally and in text forms. As Figure 1 demonstrates, what teachers and students write and talk about limits the range of opportunities to learn available to students. Thus a focus on classroom communication and constraining factors internal and external to the classroom helps us to understand what, in fact, is taught and learned in the name of school writing.

Teacher Thinking About Writing

One of the teacher's most complex and difficult jobs is to manage the myriad of contextual factors converging in the classroom. In the case of writing instruction, this problem is particularly difficult. Teachers (both elementary teachers and those at the secondary level whose expertise is not in English/Language Arts) lament their lack of experience and knowledge of writing either as writers themselves or as teachers of writing to novices. In this regard teachers report that while they are clearly in authority where school writing is concerned, they hardly view themselves as authorities on the subject.

So, after years of thinking, watching, listening, talking, and teaching, what do we claim to know about how teachers think about writing? We summarize our understanding of teachers' views on writing under four headings: Writing is different; Writing is demanding; Writing is personal; and Writing is an art.

Writing is different. Teachers think about writing and the teaching of writing as different from the other subjects taught in school. Writing is not talked about in terms of published curricula or writing programs. ("We do SCIS Science, Ginn Reading, DMP Math, and MACOS Social Studies, but for writing, we're on our own.") Writing also differs from other school subjects because it is treated as a subject of direct study, practice, and evaluation, and also as a medium through which students demonstrate academic competence in other parts of the curriculum. (A case could also be made that this is true of reading and math, but the teachers with whom we worked did not see it that way.) Thirdly, writing is seen as different because the content of school writing (when it is something meaningful to the authors) is often the author's personal experiences, perceptions, opinions, and imaginings. Under these circumstances, the teacher's role as an authority, expert, and judge are considerably less certain than in parts of the curriculum where the superior knowledge, access to information, practice, and maturity of the adult teacher set him or her apart from and above the students.

Writing is demanding. Teaching writing and doing writing in school are difficult and demanding pursuits that do not seem to become easier with time and experience. Surprisingly, experienced teachers tell us that teaching writing becomes more difficult each year, because their experiences lead them to see and to risk more possibilities for themselves and their students. Writing, like music, permits of endless variations on infinite themes.

Because of this openness of the potential tasks of school writing, and because of the relative absence of curricular structure and content, teacher planning for the teaching of writing is more demanding than planning for "teaching by the book." Teachers of writing become, of necessity, curriculum builders and evaluators--tasks for which they feel ill prepared.

Time spent in classroom writing activities is challenging and uncomfortable for teachers. Initiating a writing activity, motivating students to begin writing, helping many individuals to organize their ideas and to muster the courage to be playful and to take risks, and managing one's own behavior in a setting in which cues about how students are doing are vague all contribute to this discomfort. Writing activities do not fit well within the time and space constraints of the typical classroom and school day. Writing is vulnerable to the interruptions and distractions that characterize classroom life. And the tension between encouraging free and experimental self-expression and encouraging correctness of spelling, punctuation, and other surface features is always present.

But the demands of teaching writing do not stop at the end of the school day. The teacher must read and respond to all this text. The more successful a teacher is in having students write, the greater the demand to read and respond to student authors. Beyond the sheer time and energy load presented by teaching writing, few teachers are happy or confident about their ability to respond to the student writer in ways that are helpful, either for revision of the work in progress or for application to the next writing assignment. And this feeling of helplessness is exacerbated by the fact that the teacher finds herself or himself in the conflicting roles of audience, consultant, editor, and evaluator. Many a teacher's Sunday evening has been ruined by slogging through the painful ritual of "marking up" the margins and text of stacks of student writing.

Writing is personal. School writing is personal (and occasionally emotional) for both teachers and students. Students are seldom more vulnerable than when they write, for writing is a rather permanent form of self-expression, subject to interpretation, misinterpretation, and criticism by others. The distinctiveness and (often) unattractiveness of students' penmanship ties the writer to the text and may reinforce and exaggerate feelings of incompetence. Excellent writing typically takes more time, energy, and revision than the classroom calendar and routine permit; thus children rarely experience the personal rewards of producing work worthy of justifiable pride of authorship.

From the teacher's point of view, his or her own confidence and skill as a writer have profound effects on the ways of teaching, thinking about, and responding to students as writers. Yet few teachers are confident, competent, and reflective writers (teaching is an oral profession). Teachers draw heavily on their own remembered experiences (good and bad) as student writers in planning, deciding, and responding. Teachers, for better and for worse, put a lot of themselves into the teaching of writing.

Writing is an art. Finally, teachers tend to think about and talk about writing as an art. Not being artists themselves, the image of art and artistic performance entailed here includes heavy attributions of talent, natural ability, and inspiration as essential elements in good writing. But because talent, natural ability, and inspiration cannot be taught, this way of thinking about writing and writers tends to relieve teachers of the felt sense of responsibility for the quality of student performance. Low expectations can become self-fulfilling prophecies, reinforced by the occasional student who does indeed write well, in spite of the apparent absence of special teaching.

So, what does this add up to, the claims that teachers think that Writing is different; Teaching writing is demanding; Teaching writing is personal; and Writing is an art?

Writing tends to be slighted in American public schools. It is attended to less than other subjects because (a) the teaching and doing of writing do not fit very well with the way schools are (noisy, collective, interruption-filled, judgmental, evaluative, competitive); (b) teachers feel uncertain about how to teach and how to respond to student writers, and the students themselves resist making themselves vulnerable to criticism of their very lives, experiences, ideas, and opinions; (c) teachers and students underestimate the amount and kinds of effort involved in creating an excellent piece of writing--they think it should be easier, if they were doing it right. From this, it is easy to slip into the discouraging belief that "talent" (and lack of talent) explain the variance in performance and that there is little to be done in classrooms to help the untalented majority.

Implications for Future Research on School Writing

One of the central purposes of the Written Literacy Forum has been to come to understand the relationship between research (on writing) and the practice of teaching writing. We have come to believe that for research to contribute to the improvement of writing instruction, the design, execution, and reporting of that research must take account of the ways in which teachers think about writing. Research that is likely to have positive and lasting effects on teachers of writing will probably be different, demanding, personal, and artistic just as writing itself is. To be credible and relevant to the concerns of practicing teachers and to be interpretable within their frames of reference, research on writing instruction must be done in the classroom, with all its complexities, with teachers and even students intimately involved in the research process, and over a long enough period of time to test the staying power of the concepts and techniques under study. Breakthroughs are not likely to come quickly or cheaply, for the organization of schooling is robust and hostile to the conditions logically supportive of good writing.

Implications of our Work for Practitioners

The Forum's work has implications for improvement of writing instruction; however, our descriptive studies and discussions with teachers do not yield answers for teachers so much as they provide questions and assertions which serve as starting points from which educators can examine research, reflect upon their own practice, and plan for change.

In a recent research synthesis prepared by Forum members for the Educator's Handbook, we summarized our approach to problems of practice as follows:

> Over the years, the Written Literacy Forum has encountered a number of recurring questions about writing instruction. Of importance to both the teachers and researchers who make up our group, these questions echo the concerns of teachers across the nation who were surveyed recently by the National Institute of Education. Among the questions asked are the following: What are the current problems and challenges of writing instruction in schools? Why is writing difficult to teach? What roles do teachers play in teaching writing? What is the nature of the classroom as a place to learn to write? What does the future hold for the teaching of writing? (Florio-Ruane & Dunn, in press).

These broad questions overlap and do not lend themselves to neat and easy answers. But in asking them, the Forum has taken an important step toward interpreting and applying the enormous amount of research presently being conducted on writing instruction. Approaching research in terms of perennial problems of practice such as those named above, teachers, administrators, and policymakers can be encouraged to examine education in their own communities more critically.

If research on writing can be useful to educators in this endeavor, it will be to the extent that it offers them conceptual tools to use in framing and solving their own problems. Research cannot solve the problems of practitioners, but researchers and educators can participate as partners in inquiry into effective teaching for literacy. The Forum is one model of this partnership.

Our research into practice has yielded a series of assertions about issues of consequence to the improvement of writing instruction. These issues must be addressed by teachers, teacher educators, administrators, and researchers who seek to improve literacy education. A partial list of these issues is provided below:

1. Teacher preparation--Many teachers are inexperienced or lack confidence in themselves as writers. We need to learn more about what kind of knowledge of the writing process, of the teaching process, and of writing development would prepare teachers to teach writing more effectively.

2. Instruction--Teachers experience tensions in writing instruction between teaching about the conventions of the language (grammar) and encouraging students to write freely and create their own styles and voices. Research and practical experience must be applied to the management of this tension.

3. Curriculum--In the absence of adequate preparation to teach writing, teachers may find themselves teaching writing as they were taught. Often this teaching takes a lockstep approach in which vocabulary precedes sentences, sentences precede extended text, and extended text is rarely written by most students. In addition, teachers express difficulty in responding to students' writing at levels other than the word or sentence. We need to learn more about the limits of response to writing and the kinds of response most likely to enhance students' writing growth.

4. Teacher's role and classroom context--The "process approach" to writing is growing in popularity and prominence in our elementary and secondary schools. In this approach students write multiple drafts of longer texts, and teachers play a variety of instructional roles. At various times in the student's planning, writing, and revision of a document the teacher may alternately encourage or motivate writing, offer technical assistance, help the writer to clarify meaning and intentions, and aid in the publication of a student's work. We need to learn more about these and other instructional roles and realistically assess their efficacy in crowded classrooms and curricula.

5. Planning--Planning for writing instruction appears to differ somewhat from planning in other academic subjects. This may be due in part to the nature of writing itself and also to the relative absence of district mandates and packaged curricula for writing. In writing, teachers are challenged to create their own curricula. We find that experienced teachers tend to develop loosely framed long-range plans for writing and emphasize flexible, activity-based plans for individual lessons. This approach to planning differs from the lesson and unit planning typically taught to beginning teachers and evidenced in research on their thinking.

6. Technology--The future of writing instruction includes the application of computer technology. Computers are used to teach various aspects of the writing process including drill and practice of isolated skills, tutorial programs teaching elements of text structure, software offering electronic mail and other interactive writing opportunities, and word-processing programs. Research on computers and writing is in its early stages. Research and practical experience should enable critical assessment of the computer as a tool for teaching writing. Teachers play an essential role in adapting instructional technology to their writing curriculum and its goals. Thus when approaching new technology, they must be learners who also lead in the application of computers to writing instruction.

Annotated Bibliography

This section offers the titles and brief annotations describing several published pieces dealing with each of the major themes of the Forum's work. The annotations, taken together, constitute a brief statement of major conclusions.

Florio, S., & Clark, C.M. (1982). The functions of writing in an elementary classroom. Research in the Teaching of English, 16, 115-130.

This article summarizes the theoretical and empirical foundations of the Written Literacy Forum. To quote the abstract: "Little is known about the role played by writing in the lives of children either inside or outside school." The ethnographic study of writing in the classroom can inform us about the perspectives of both children and their teachers concerning writing and its communicative functions. This study analyzes the functions of writing in one elementary classroom. The following four functions of writing are identified in the classroom: writing to participate in community, writing to know oneself and others, writing to occupy free time, and writing to demonstrate academic competence. These four functions are not commented on directly by participants but inferred by ethnographic study to be the purposes for which their writing is undertaken. As such, the functions are interpretable in light of the social context of school and classroom and constitute an informal writing curriculum. Understanding and awareness of the functions of writing in the classroom can aid the acquisition of writing by helping teachers to furnish and take advantage of meaningful and diverse opportunities for student writing."

Clark, C.M., & Florio, S. (1983). The Written Literacy Forum: Combining research and practice. Teacher Education Quarterly, 10,(3), 58-87.

This article describes the mission, organization, and early fruits of the Forum to an audience of teacher educators. The Forum is offered as an example of collaboration, human and institutional relationships, and interdependence among researchers and teachers. The article recounts the evolution of the Forum during its first two years of operation and includes an appendix of teacher-developed materials used in Written Literacy Forum inservice activities. This appendix is notable in that it represents the first publication and dissemination of text written by Forum teachers.

Florio-Ruane, S., & Dohanich, J. (1984). Communicating findings by teacher/ researcher deliberation. Language Arts, 61, 724-730. (Also available as Research Series No. 151, East Lansing: Michigan State University, Institute for Research on Teaching)

This paper questions the time-honored, research-to-practice tradition. The authors are a researcher and a teacher who were members of the Written Literacy Forum. They describe the Forum's deliberations about the teaching of writing in classrooms. The authors note that teachers and researchers operate in different professional communities and may have different views about the relevance and usefulness of research findings. Deliberation between teachers and researchers affords teachers control over the interpretation of research findings for their own practice and allows researchers access to new perspectives on findings and new understandings of teachers' concerns.

Florio-Ruane, S. (in press). Conversation and narrative in collaborative research (Occasional Paper No. 102). East Lansing: Michigan State University, Institute for Research on Teaching.

The Written Literacy Forum taught us many things about teaching writing, but it also served as an experiment in bringing the worlds of research and teaching together. This paper reports on the latter Forum activity. In conversation, Forum teachers and researchers deliberated the following questions: For what audiences and purposes is educational research conducted? What forms of language are used to communicate research knowledge? How does research knowledge differ in its content and form from the knowledge held and used by teachers? What is the status of each kind of knowledge in the field of education? This paper reports on how the Forum's deliberations encouraged members to state and examine their assumptions about what researchers and teachers claim to know. The paper also explores some of the different ways researchers and teachers express knowledge about teaching and looks at the views they hold of themselves and each other as professionals.

Dunn, S., Florio-Ruane, S., & Clark, C.M. (1985). The teacher as respondent to the high school writer. In S.W. Freedman (Ed.), *The acquisition of written language: Response and revision* (pp. 33-50). Norwood, NJ: Ablex. (Also available as Research Series No. 152, East Lansing: Michigan State University, Institute for Research on Teaching)

An important theme throughout the work of the Forum has been the issue of response to student writers. This chapter examines response in the context of high school creative writing. This case study illustrates one writing teacher's approach to the role of respondent to his student writers. Three researchers spent one year documenting his planning and teaching and eliciting students' perspectives on the writing they did in his class. The many roles this teacher enacted during writing instruction and the variety of types of response he offered to his students (e.g., teacher as motivator, coach, model) are described.

Thomas, D.B. (1985, February). *University researchers and teachers as colleagues in classroom research*. Paper presented at Meadow Brook Research Symposium on Collaborative Action Research in Education, Rochester, MI.

This paper was presented by one of the teachers who was involved with the Forum for several years at a conference on collaborative research. Through her descriptions of the development of her relationship with university researchers, she opens for discussion many issues with respect to collaborative research. In Thomas's words, the researchers "seemed to be genuinely interested in how we taught children, especially writing. . . . My intellectual ego soared, as this was the first time in my teaching career that I had discussed teaching with colleagues over a consistent extended period of time" (p.2). But she also cautions that, because teachers and researchers come from two distinct environments, building collaborative relationships requires hard work and trust building. Among the issues Thomas had to adjust to were language differences, the slower pace of research (in contrast to teaching), the differences in the tasks of daily routines of teachers and researchers, and changes in relationships with elementary school co-workers as a result of her involvement with this research project.

Florio-Ruane, S., & Dunn. S. (in press). Teaching writing: Some perennial questions and some possible answers. In V.R. Koehler (Ed.), The Educator's Handbook. New York: Longman.

This chapter offers a selective review of the current field of research on writing and writing instruction. Our work with the Forum has strengthened our conviction that if research on writing is to be useful to educators, it will be to the extent that it offers them conceptual tools to use in framing and solving their own problems. Thus, this chapter is organized around several questions that are of perennial concern to teachers, administrators, and policymakers. Among the questions asked here are the following: What are the current problems and challenges of writing instruction in schools? Why is writing difficult to teach? What roles do teachers play in teaching writing? What is the nature of the classroom as a place to learn to write? What does the future hold for the teaching of writing? The chapter includes an annotated bibliography for use by teachers and curriculum developers.

Clark, C.M. (1986). Research into practice: Cautions and qualifications. In T.E. Raphael (Ed.), The contexts of school-based literacy (pp. 281-293). New York: Random House.

At the heart of the mission of the Written Literacy Forum is a search to understand constructive and mutual influences of research on practice and of practice on research. This chapter, originally offered as a paper presentation at a conference of teachers of writing, takes the position that research can best serve teaching when three conditions obtain: (a) The research questions, design decisions, and interpretations are formulated jointly by teachers and researchers; (b) the process of inquiry is appreciated as a powerful professional development opportunity for all concerned; and (c) the fruits of the study of teaching are construed as including six classes of outcomes, namely, relationships among variables, concepts, theoretical models, questions, methods of inquiry, and case studies. The author calls on teachers and researchers to think about literacy research as service as much as science and to take more optomistically responsible action in communicating about literacy education.

References

Florio-Ruane, S., & Dunn, S. (in press). Teaching writing: Some perennial questions and some possible answers. In V.R. Koehler (Ed.), *The educator's handbook*. New York: Longman.

Scarmadalia, M., & Bereiter, C. (1986). Research on written composition. In M.C. Wittrock. (Ed.), *Handbook of research on teaching* (3rd ed., p. 778-803). New York: Macmillan.

SCIENCE TEACHING

In spite of the major efforts made during the last 25 years to improve science teaching and science curriculum materials, students' mastery of important scientific concepts and principles continues to be less than what it should be for a technologically advanced nation. In particular, students' prior misconceptions about science topics often interfere with their ability to get the intended meaning from science lessons. Presently, however, few teachers or curriculum developers are fully aware of these misconceptions and their effects on student understanding.

In the past, the Science Teaching Project has developed science program materials that provided teachers with specific information about student misconceptions and suggested activities that might help students to overcome those misconceptions. These materials produced important improvements in teacher behavior and student learning. Over the past two years, project staff have been investigating the effects of teacher training as an alternative means of communication with teachers, and they are investigating how teachers' knowledge and beliefs affect their teaching behavior and their students' learning.

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SCIENCE TEACHING

Project Summary

Background and Design of the Study

Our present system of science education is not working very well. This fact is documented not only in a variety of reports on the present crisis in science and mathematics education, but also in our own research on students entering college science courses (Anderson, Sheldon, & DuBay, 1985; Bishop & Anderson, 1985; Hollon & Anderson, 1985). It appears that in most science courses only a small minority of the students are truly learning with understanding. We have concluded that one of the most basic problems with science teaching stems from a misunderstanding by teachers and curriculum developers of how learning with understanding occurs.

Students generally enter science courses with beliefs about how the world works that are reasonable but incompatible with accepted scientific theories. In our previous work, we have generally referred to those unscientific beliefs as misconceptions. Learning with understanding can occur only through a complex process of conceptual change in which students reconsider and modify their thinking about what the world is made of and how it works. Unfortunately, this is not generally what happens. Instead, most students memorize enough to pass tests while continuing to hold misconceptions.

Our previous research indicates that this does not have to be the case. We have seen teaching that helps most students overcome their misconceptions and learn with understanding, often with the help of materials that we have developed (Anderson, 1985; Smith &

Anderson, 1984). We have concluded from our previous research that often teachers are not successful because they generally lack the knowledge they need to produce conceptual change in their students.

In thinking about the problem of teacher knowledge, we have hypothesized that successful teaching for conceptual change depends on knowledge of two types. First, teachers need a general orientation toward conceptual change: an understanding that students can learn with understanding only by going through the process of conceptual change and a determination to help them do so. Second, teachers need specific knowledge, including the following:

1. Knowledge of science content, and how it can be transformed into curricular goals
2. Knowledge of students and the specific misconceptions that are likely to affect understanding of the topic being taught
3. Knowledge of teaching strategies that will help students overcome their misconceptions

Our previous research has been devoted to developing knowledge of each type and making it available to teachers. In the process of doing that research, it has become clear that teachers differ considerably in the nature and extent of their previous knowledge and that those differences affect their responses to new information.

Since our previous studies were not designed for the purpose of studying teachers' knowledge and its effects on instruction, they produced interesting but unsystematic information about how teachers acquire and use knowledge. The present study was designed to remedy that deficiency. The goals of the study were as follows:

1. To investigate the nature of the knowledge bases used by science teachers and the relationship of those knowledge bases to effective teaching practice
2. To compare the effectiveness of different methods of improving teachers' knowledge

The design of the study is outlined in Table 1. The study focuses on the teaching of three target units in middle school life science: photosynthesis, respiration, and ecological matter cycling. These units were selected because we have some understanding of students' conceptual problems with these topics from our previous research and because most of the teachers in the study selected them as units that they would be willing to teach to their classes.

Key Findings

Data from this project were organized into three large sets. First, we had data from interviews with teachers given at the beginning of the study and after each of the three units. These data gave us a great deal of information about teachers' knowledge. Second, we had data analyzing classroom observations and materials used in class which informed us about teaching strategies and materials. Third, we had results from pretests, posttests, and delayed posttests which informed us about student learning and retention. Many of the most interesting results concerned relationships among these data sets. Some of the key findings are summarized below.

Findings related to teachers' knowledge. Our analysis of the interviews with the teachers showed teachers taking three general

Table 1

Design for Year 2

Group 1	Group 2	Group 3
Training (4 teachers)	Materials (5 teachers)	Training with materials (4 teachers)
Pretest on all topics	Pretest on all topics	Pretest on all topics
Training	--	Training
Teach Photosynthesis with own resources	Teach Photosynthesis with provided materials	Teach Photosynthesis with provided materials
Photosynthesis posttest	Photosynthesis posttest	Photosynthesis posttest
Training	--	Training
Teach Respiration with own resources	Teach Respiration with provided materials	Teach Respiration with information about student misconceptions and own materials
Respiration posttest	Respiration posttest	Respiration posttest
Teach Matter Cycling with own resources	Teach Matter Cycling with own resources	Teach Matter Cycling with own resources
Delayed posttest on all topics[a]	Delayed posttest on all topics[a]	Delayed posttest on all topics[a]

[a] The delayed posttest was administered in only 11 of the 13 classrooms.

views of the process of teaching and learning in science classrooms. Teachers holding a conceptual development view of science teaching had ideas about the nature of science and science learning which were similar to those on which the Science Teaching Project is based. They viewed science learning as an accommodative process in which students had to develop more powerful explanations of the natural world. Teachers in the content understanding group placed more emphasis on learning as a process of assimilation in which students integrated new concepts into existing knowledge. Teachers in the fact acquisition group viewed learning as the mastery of facts in curriculum materials. These teachers' concerns often focused primarily on issues other than the learning of science, such as management and motivation, or the learning of study habits and self-control.

These views of teaching and learning affected the teachers' responses to new information, whether this information came from our workshops and materials or from their own experience in teaching. Thus, we hypothesize that these three viewpoints tend to act as self-reinforcing belief systems, affecting teachers' responses to new information and experience as well as their current thinking and behavior.

The teachers' views of teaching and learning stayed fairly stable over the course of the project; they were not strongly affected by either the workshops or our teaching materials. In general, the conceptual development and content understanding teachers were more likely to use the teaching strategies we believe to be associated with conceptual change, though this pattern was strongly affected by the presence or absence of our teaching materials and other factors. The association between teachers' views and success in promoting student understanding is less clear. Statistically, 13 teachers are not enough to sort out all of the multiple factors affecting student learning.

Findings related to classroom processes and student learning. This study was, in part, a process-product study of relationships between classroom processes and student learning. We looked at relationships between gains in student understanding and characteristics of both teaching strategies and materials used by teachers. In general, we found that these relationships paralled findings from earlier studies done by us and others (Anderson & Smith, 1983; Minstrell, 1984). Strategies associated with superior student learning included the use of scientific principles to explain phenomena (especially everyday phenomena), questioning strategies that required explanation and problem solving by students, the use of advance organizers, and explicit contrasts between scientific conceptions and common student misconceptions.

Relationships with student learning were generally much stronger for variables coding academic tasks (written work) and with sources of information (primarily textbooks and other reading material) than they were for variables coding classroom tasks. A variety of explanations for this result are possible; at the least, though, it indicates the importance of what students read and write as well as classroom discussions. The strength of the relationships between teaching strategies and student learning also varied from unit to unit, with the strongest relationships being found with the photosynthesis unit, where there was considerable curricular consensus about the purposes of the unit among us and the teachers in the project. Both teaching strategies and student learning were strongly affected by the use of the materials that we had developed. The materials were fairly "robust" in their effects; that is, they provided teachers with knowledge and support that helped them to teach effectively in spite of differences in teachers' beliefs and in characteristics of students. The workshops, in contrast, did not have effects that we detected on either teaching strategies or student learning.

These findings emphasize again how difficult it is to teach science for conceptual change without adequate support. The teachers in this project included the best science teachers that we have ever observed: experienced, dedicated, and very knowledgeable about both science and their students. Even these teachers, however, were constantly faced with the dilemma of either trying to develop materials on their own or reorganizing and reconceptualizing the information that was given to them in textbooks and other materials. It is almost impossible to do this consistently and thoroughly under present working conditions.

This study also included a retention test given several months after the completion of the units. So far, we have been able to complete the analysis of the retention tests for only the respiration unit. For this topic there were significant declines in student performance between the posttest and the retention test. These declines were present in all classes and affected most, but not all, students. When we analyzed a single class set of photosynthesis tests, however, student performance actually improved between the posttest and the retention test, which was given over six months later. The results of this partial analysis raise more questions than they answer for us. They have had the effect, though, of greatly increasing our interest in the issue of long-term retention.

Concerns and Implications

Since its inception, the Science Teaching Project has been an improvement-oriented project. We aspire not only to understand science teaching but also to change it for the better. We believe that we have made some important contributions to both understanding and improving science teaching through this study and our previous studies. We have contributed to the development of a knowledge base about how students learn science. We have also developed an understanding of teaching strategies and properties of instructional materials that promote conceptual change in students. We have learned something about the knowledge teachers need in order to use conceptual change teaching strategies and about barriers to their successful use. We have developed materials that enable classroom teachers who do not have special training or expertise to enhance greatly their effectiveness in teaching for conceptual change.

In contrast, we still find ourselves at the conclusion of this study with several major unsolved problems. Among the most important of these problems are the issue of long-term retention and the need for a program of incremental change in our system of science education.

The decline in student test performance between immediate and delayed respiration posttests and the at least partially contradictory results for photosynthesis confront us with the question of how students will benefit from science instruction over the long term. What kind of understanding do we really want our students to achieve? How can we measure it? How can we teach for it? What was different about the students whose performance did not decline? We feel that currently we do not have adequate answers to these questions. A parallel question exists for teachers: How can we support the development of knowledge that will be truly useful to them when special teaching materials are not available?

The issue of long-term retention suggests that the changes we have recommended in science education may not be enough. In another sense, though, they may be too much. Our experience of the last six years has convinced us that major structural changes in science education are desirable. The teachers in this study included the most talented science teachers that we have ever worked with. Much of their energy and talent, however, is currently consumed in compensating for unnecessary deficiencies in the materials that they work with or in their working conditions. In the classrooms of other less talented teachers, we see little evidence that desirable learning is taking place at all. We owe all of these teachers and their students more opportunities to achieve their full potential as teachers and as learners.

In the American education system, however, such major changes are likely to take place gradually or not at all. Therefore, we need a program of incremental change, one that will produce demonstrable short-term improvements while helping to build knowledge and support in the system for larger systemic changes. We do not feel that we have yet developed such a program. Instead, we have developed an instructional approach that is very difficult for teachers to implement without either specially developed materials or intensive training and (probably) changes in working conditions. We still need some "first steps": specific recommendations that (a) are relatively simple and inexpensive to implement here and now, (b) lead to improvements in practice that are clearly visible to teachers and administrators, and (c) prepare teachers for further change in curriculum and instruction.

Thus, we feel that the Science Teaching Project can look back on a record of accomplishment, but we also need to look forward towards both major problems and specific questions that we are just beginning to address.

Progress Since March 1986

The six months since the last progress report have been devoted almost exclusively to data analysis. This analysis has involved three large data sets:

1. Interviews with teachers conducted prior to the beginning of intervention and at the end of each unit. These were thus 4 interviews for each of the 13 teachers in the study, a total of 52 interviews.

2. Classroom observations and analyses of academic tasks (assignments, tests, etc.) and sources of information (textbooks, films, etc.) used in each class. Data on classroom teaching were organized into "unit packets," each containing 3-5 classroom observations plus all the academic tasks and sources of information used by a teacher for a unit. There were 39 of these unit packets in all, three for each teacher.

3. Pretest, posttests, and retention tests for each unit. Two-thirds of each class (randomly selected) took each pretest and retention test. All students who were present took each posttest. Retention tests were administered in only 11 of the 13 classrooms. In all, about 600 pretests, 900 posttests, and 500 retention tests were administered.

Analyses have been conducted for all data except the photosynthesis and matter cycling retention tests, following procedures described in the last progress report. Additional analyses looking at relationships among those data sets have also been conducted. Some of the findings from those analyses are described below. We have divided our findings into two sections: (a) findings concerning teachers' knowledge, factors that affect teachers knowledge, and its relationship to classroom teaching strategies and student learning, and (b) findings concerning classroom teaching strategies, their antecedents in teachers' knowledge and teaching materials, and their effects on student learning.

Teachers' Knowledge

We began this study believing that teaching performance depended on both teachers' general orientations toward teaching and learning and topic-specific knowledge of content, students, and teaching strategies. Our analyses to date have focused primarily on teachers' general orientations. The primary data sources for those analyses have been the teacher interviews.

The total data set consisted of 52 interviews, including pre-interviews and 3 post-interviews for each of the 13 teachers. Our analyses have focused primarily on the post-interviews. The teachers were generally dedicated people who were working hard to help their students learn science. However, they defined and approached this task in very different ways. Among these teachers, we saw three general approaches to the teaching and learning of science. The conceptual development and content understanding approaches represented the ends of a continuum rather than truly distinct approaches. Teachers taking a fact acquisition approach held beliefs that were substantially different from those of teachers in the other two groups. The teachers taking a conceptual development approach viewed learning as a process of accommodation in which students had to change their thinking about the natural world. Therefore, they were most likely to ask questions and engage in classroom discussions which provided them with information about students' scientific thinking. These teachers were also the most likely to hold views of the science curriculum which emphasized having students use scientific theories for explanation and other purposes.

The content understanding teachers viewed learning as a process of assimilation in which students integrated new concepts into existing knowledge. These teachers' questioning and discussion strategies generally focused more on students' acquisition of new information and less on the nature of their scientific thinking than the conceptual development teachers. Their curricular views tended to emphasize the importance of having students understand science as an integrated body of knowledge more than having them use scientific knowledge for explanation and other purposes.

The teachers taking the first two approaches tended to differ in degree of emphasis rather than their fundamental views of science teaching and learning. Teachers taking the fact acquisition approach, however, defined their roles in a substantially different way from teachers taking the other two approaches. The fact acquisition teachers tended to view science learning per se as less central and to place relatively more emphasis on other issues such as motivation, management, and the development of students as individuals. Their teaching strategies emphasized managing classroom activities which exposed students to information or facts defined by the text or district science curriculum. Their questioning strategies emphasized checking students' assignments and memory of facts. They did not treat the monitoring of students' scientific understanding as central to their role as teachers; thus they knew less than the other teachers about their students' scientific thinking. Differences among the three groups are summarized in Table 2.

Table 2

Teachers' Beliefs About Students' Learning and Their Role in Promoting Learning

	Conceptual Development	Content Understanding	Fact Acquisition
The nature of learning	Learning occurs as students change the way they think about the world	Learning involves acquiring new ideas or knowledge about the subject	Students' learning processes are not understood or not perceived as important; goals emphasize emotional or social development
Exploration of students' failure to learn	Students' thinking hasn't changed; still using old ideas	Important information not remembered; learning tasks are too complex; too many steps for students to follow	Students not motivated, incapable, or lack basic skills
Nature of science curriculum	Mastery of important disciplinary concepts and their applications to the real world	Understanding of a a narrative describing how living things work in the real world	Mastery of facts and skills defined by the text or the district science curriculum
Important teaching roles	Monitor students' thinking; help to develop scientifically appropriate ways of viewing the world	Clearly communicate nature of subject matter; check for understanding of important details	Manage classroom activities and resources; support students' emotional needs

Factors affecting teachers' approaches. For each group, it appeared that the teachers' knowledge and classroom behaviors combined to produce self-reinforcing belief systems: What they had learned about their students from discussions and class assignments was consistent with their beliefs about their students' learning processes. The conceptual development teachers had developed detailed knowledge of their students' thinking about natural phenomena. They were able to predict students' responses to our test questions and explain why responses were likely. They perceived resources containing information about students' thinking as important and used them to plan and teach. Thus, their beliefs about the role of students' thinking led them to engage in teaching behaviors which provided information about students' thinking and to use that information when they taught.

The content understanding teachers had also developed knowledge of their students' thinking; however, their beliefs about the additive nature of learning lead them to perceive students' misconceptions as gaps in understanding rather than an alternate way of viewing the world. Thus, they viewed information about students' misconceptions as interesting, but not as defining key problems for curriculum and instruction.

The fact acquisition teachers possessed little knowledge of their students' thinking and were generally unable to predict their responses to our test questions. They seldom perceived resources containing information about students' thinking as important to their teaching, and in particular, avoided assignments and discussions that would have produced discrepant information about the nature of their students' understanding of important concepts.

For the teachers in our study, all of whom had at least 10 years' experience, these belief systems seemed to be well established and fairly stable. A teacher's beliefs about teaching and learning, specific knowledge and skills, and habitual patterns of planning and teaching tended to combine into an integrated whole that could be changed only by sustained effort on a variety of different fronts. The treatments in our study clearly were not sufficient to support such a sustained effort in the entirety. We raised issues for the teachers without providing the support necessary for their satisfactory resolution, except for the specific units where we developed teaching materials. Thus during the course of the project we saw changes at the level of teachers' specific knowledge and teaching strategies, but not changes in their basic approaches to teaching.

Given the stability of the approaches to teaching, the question of how they originate is obviously an important one, especially for preservice teacher education. Although this issue was not addressed by the present study, some comments are possible. First, these approaches clearly are not developmental stages. There was no relationship between approaches to teaching and amount of teaching experience. Student socioeconomic status may be a factor, but we observed both conceptual development and fact acquisition teachers in both high-and low-SES schools. Of the factors that we know about, the evidence for the importance of background in biology is the most convincing. All four of the fact acquisition teachers had majored in disciplines other than science. Most, though not all, of the conceptual development and content mastery teachers had strong backgrounds in biology.

The problem of how teachers adopt a particular approach to teaching deserves further investigation; it could be that many teachers establish a particular approach fairly early in their careers and that approach strongly influences what and how they learn from experience and inservice teacher education.

Effects on classroom strategies and student learning. At the case study level, it is clear from our data that teachers generally used strategies in the classroom that were consistent with their views of teaching and learning. In general, this meant that teachers taking conceptual development and content mastery approaches were more likely than fact acquisition teachers to use conceptual change teaching strategies. Teaching strategies though, were also affected by many other factors, including the nature of available materials, the amount of time available for planning, management styles, and experience with the particular topic being taught.

In addition to all the factors mentioned above, student learning was also affected by a variety of other factors, including student background, curricular agreement between the unit as taught and the posttest, and amount of time devoted to the unit. Our data simply do not allow us to sort out the effects of all those factors. The results of this study clearly indicate the naivete of assuming that there is a straightforward statistical relationship between student learning and the knowledge and skills of individual teachers.

Teaching Strategies and Student Learning

This section deals with teaching strategies used by the teachers in the study, with their antecedents in treatments and teachers' knowledge, and with their effects on student learning. Based on our own previous research and that of others, we hypothesized that the use of certain kinds of teaching strategies would promote conceptual change learning in students. Among these strategies are the use of questions that require students to make predictions and give explanations, the use of everyday phenomena in both student tasks and teacher explanations, the contrasting of naive and scientific explanations, and the probing of student responses for clarification and further reasoning. Indeed, the study was designed to test alternative means of helping teachers come to understand the importance of and use such strategies. However, it also provided an opportunity to examine our hypotheses about the value of these strategies in promoting conceptual change learning.

Three sets of categories were defined reflecting recommended strategies for conceptual change teaching (Anderson & Smith, 1983, in press; Roth, Anderson, & Smith 1983, Minstrell, 1984). One set was used to code strategy use in whole class instruction. The second was used to code tasks performed by students in individual or small-group assignments. The third was used to code strategy use in information sources, primarily textbooks, used by students. Data from these three sets of categories are presented separately and are referred to as class, task, and source strategies, respectively.

Treatment effects on teaching strategies and student learning. The design involved three groups of teachers each teaching three different topics with different combinations of materials and training being provided (Table 1). There were differences among the treatment groups in strategy use; However, the major result was that these differences were associated with the use of our specially designed instructional materials. Teachers using our materials used conceptual change teaching strategies more frequently than when materials were not provided.

The differences in strategy use associated with the use of our materials were greater for the task and source strategies than for the class strategies. This reflects the paucity of commercial materials that make use of conceptual change strategies. Tasks and sources that used these strategies were often designed by the teachers themselves rather than obtained from textbooks or other materials.

Within the class strategy data, when teachers were not provided with materials, there was a tendency for bigger drops in conceptual change strategy use in presenting new information than in questioning strategies.

One of the purposes for the design of the study was to be able to compare the transfer effects of the use of our materials and training to situations where no materials were provided. That was the purpose of the third topic (Matter Cycling). The summary data suggest contributions for both training and use of our materials to increased strategy use on the transfer topic; however, the large variation within treatment groups and the relatively small differences limit its statistical and practical significance. Furthermore, comparisons between Groups 1 and 3 for the respiration unit are inconsistent with this trend.

A similar pattern was apparent in the data on student learning. The analysis of student learning by treatment involved analysis of covariance on posttest scores using pretest scores as the covariate. Differences among groups were significant ($p < .05$) for the photosynthesis unit and approached significance for the respiration unit, but not for the matter cycling unit. The groups that used our materials did better than the groups that did not. There were no other significant differences.

In summary, while use of our materials contributed to improved conceptual change learning, we found no evidence for the effectiveness of the workshops. Furthermore, we did not find evidence that either training or the use of our materials had a facilitating effect on teaching strategies or student learning for a subsequent unit.

Strategy use and student learning. This part of analysis followed the procedures employed in process-product research. The relation between the frequency of use of various strategies and student learning was assessed by entering the variables into a regression equation after first entering pretest scores. Since each unit had its own test, the analysis was conducted separately for each of the three units.

Because of the low number of cases (13), a significance level of $p < 0.2$ was adopted for the F statistic for the change in R square. This corresponds to a correlation of about 0.4 which is fairly high for process-product research. We then looked for strategies for which the results were significant for at least two of the three units. This criterion eliminates many of the individual false significant relationships caused by the high significance level.

We coded data for 40 categories. About half of them reflect recommended strategies for conceptual change teaching (Anderson &

Smith, 1983, 1986; Roth, Anderson, & Smith, 1983; Minstrell, 1984). The others reflect strategies that we did not expect to relate to conceptual change learning (such as open-ended and memory questions) or whose rationale is not based on conceptual change research (such as advance organizers and summarizing). Ten of the categories had very low frequencies for all treatment groups for all units and were dropped from the analysis.

Of the 48 tests of the conceptual change strategy categories, 21 were significant. This is about twice as many as would be expected by chance with a criterion of $p < 0.2$. Seven of the 16 conceptual change strategy categories met the criterion of achieving significance for two of the three units. These included questioning strategies which require students to predict or reason to make a choice (class), which require students to construct explanantions (task), and which bring out students' misconceptions (task). Also meeting this criterion were strategies in which scientific explanations of relevant phenomena were provided (class & source), contrasts between naive conceptions and scientific alternatives (source), and the use of everyday phenomena (source).

Using advance organizers (defined to include setting up a framing problem as well as presenting an overview of the main idea to be addressed) was the only nonconceptual change category to meet the criterion of significance for at least two units (source). Asking open-ended questions and asking memory questions were consistently negatively correlated with posttest performance, although each was significant for only one unit (task).

One further pattern in the results also seems important. All of the 10 conceptual change strategy categories for task and source data were significant for the photosynthesis unit, where about two-thirds of the teachers were using our materials. Only 4 were significant for the respiration unit where about a third of the teachers were using our materials. Only 1 was significant for the matter cycling unit where we did not provide materials for any teachers. In contrast, strategies used by the teacher in whole-class instruction (class) were significantly related more frequently in the respiration and matter cycling units (3 and 2 instances, respectively) than was the photosynthesis unit (only 1 instance).

In general, these results support the claim for the usefulness of the recommended strategies in promoting conceptual change learning. They also indicate the usefulness, and perhaps the necessity, of appropriately designed intructional materials in supporting teachers in the use of conceptual change teaching strategies. They further indicate the importance of writing and reading in the learning of science.

Strategy use by teachers with alternative views of teaching and learning. As described above, teachers were grouped according to their views of teaching and learning, based primarily on the interview data. We examined the teachers' use of conceptual change teaching strategies based on their classification into these groups. For this purpose, we examined only those strategies that were not tied directly to the use of our materials. Whether we looked at the use of class strategies for all units, class strategy use for matter cycling only, or task and source data for those units where we did not provide materials, the pattern was similar. With one exception, the fact acquisition teachers consistently used fewer conceptual change strategies than the others. Thus, in this regard, their behavior is consistent with their views as reflected in the interviews. The differences due to teachers' orientations were not, however, as large as the differences associated with use of our materials.

Discussion

The two most important findings emerging from our analyses to date are (a) the description of general trends in teachers' orientations to teaching and learning and (b) the effects of materials on teaching strategies and student learning. The materials we developed had a powerful effect on both teaching strategies and student learning. Teachers' orientations clearly affected their choices of teaching strategies and materials. The effects of other factors that we considered, including workshops, teacher background, and students' socioeconomic states or prior knowledge, are probably present, but the data do not clearly support an argument for their influence.

The analyses that we have completed to date have been best suited to detecting general trends that prevail across teachers and across units. The small number of teachers and the multitude of differences among them meant that data provide clear support for only the strongest general trends. There is still a multitude of important questions, however, that can be addressed by finer-grained analyses.

For example, the fact that we did not see general effects from the workshops or transfer from one unit to another does not mean that the teachers were unresponsive to those experiences. In fact, there are clearly ways in which each teacher in the study altered his or her thinking and teaching. An analysis that focuses on individual teachers rather than checking for changes in pre-established categories may reveal patterns that are obscured by our present analysis.

We also have a wealth of information about teachers' specific knowledge that remains to be analyzed. How did teachers' understanding of content, students, and teaching strategies change for the specific units that they taught? How were those changes affected by treatment, general approach to teaching, and other factors. How is specific knowledge related to choice of teaching strategies?

Our data could provide at least partial answers to these questions. We hope to answer some of them as we develop papers for convention presentations and publications.

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SECONDARY SCHOOL SCIENCE

This study was designed to gain an understanding of factors that influence and limit the interactions among secondary science teachers, school administrators, and external agents, including university faculty and state education department personnel. Information sought includes (a) a thorough description of the nature of interactions among school staff members and with external agents, (b) an understanding of the cognitive and affective factors bearing on these interactions, and (c) an understanding of the processes by which dialogue can be increased among teachers, school administrators, and external agents as a vehicle for improving instruction in secondary science.

The study was enthnographic in nature; that is, the techniques of anthropologists were used to study the culture of secondary schools and to discover the nature of the interactions that occur and the values underlying them. Change agents were introduced to modify the communication patterns in the school as a means of improving instruction in science. The study was conducted in two school districts.

This study is important because science teaching is suffering from lack of coordination and leadership. Individual teachers, acting autonomously, are not meeting the educational needs of the broad spectrum of students in secondary schools. They have created a mystique of specialization that precludes productive interaction about teaching with administrators. Moreover, administrators have accepted and encouraged this autonomy. This situation is especially detrimental to females, minorities, students from low-income families, and handicapped students because science instruction in secondary schools has retained the elitism associated with preparation of a few bright students for careers in science.

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SECONDARY SCHOOL SCIENCE

Project Overview

Purpose and Methodology

The primary questions investigated by this study were, What is the nature of the interactions among secondary school science teachers, school administrators, and external agents? and How do these interactions influence the character of the science program? Given that, the specific purposes of this study were to

Describe fully the nature of interactions between secondary school science teachers, school administrators, and external agents in secondary schools in the two districts.

Attempt to "see the world through the eyes of the teachers and administrators" and by doing so gain insights into the values, attitudes, beliefs, knowledge, and skills that underlie and shape their interactions.

Identify sources of new information used by teachers and administrators and describe how this new information is assimilated into the curriculum and how it, in turn, affects practice.

Attempt to understand the process by which dialogue can be increased among science teachers, school administrators, and external agents in the context of modifying the secondary school science program to achieve a wider set of goals for a broader segment of the secondary school population.

These purposes implied the need for descriptions of behavior and understanding of what lay behind the behavior. Because of the nature of the questions asked, the approach used was ethnographic. Under the direction of the principal investigator, six graduate students, and one undergraduate professorial assistant regularly visited five schools in two districts to observe secondary science classes and discuss organization, content decisions, teaching strategies, and other choices made by teachers, department heads, and administrators. Informal meetings and formal interviews with school staff members were also part of the planned procedures for data collection. Other important data sources included review and analysis of texts, other instructional resources, tests, and policy documents as well as participant-observation by project staff members who worked with teachers and department heads in classrooms, laboratories, teacher workshops, and planning meetings. Also during the past six months, project staff members have engaged in cooperative activities with school personnel aimed at improvement of instruction in science.

Description of the Sites

Two districts participated in this study: a medium-sized city school district and a village school district. In the city district, observations were made in a 2000-student high school incorporating grades 9-12 and a 1250-student middle school that included grades 6-8. Both schools draw a varied population of students representing a range of socioeconomic and racial backgrounds with approximately 40% of the student population Black and 10% Hispanic.

In the village district, three schools were included to provide continuity in examining the secondary science instructional program from grades 6-12: A middle-school (6-8) located in a rural area; a grade nine building that once was the entire high school; and the district's only high school (grades 10-12) located in the residential section of the village two blocks from the grade nine building. Enrollments in the three centers were 527, 470, 1207 respectively. Nearly all students in the village schools are Caucasian and the families in the district represent a cross-section of socioeconomic levels including farmers, small business operators, government workers, university faculty, factory workers, and unemployed persons. The general climate of the community can be best characterized as moderately conservative.

In City High School, no science courses were required during the time covered by our study, but one year of science will be required of all graduates beginning with the 1988 graduating class. Because all science courses were electives during the period of our study, only 5 science teachers were required to staff the 2000-student school. By contrast, two years of high school science were required for graduation from Village High School and 12 teachers comprise the science faculty for grades 9-12. In middle schools in both districts, all students enrolled in science in grades 6-8; City Middle School had 10 teachers assigned to science whereas the smaller Village Middle School had 4 science teachers.

Synopsis of Previous Findings

During the first 18 months of the project, we made over 900 science class observations. We also conducted over 200 interviews and informal discussions also were conducted with science teachers. Sources of data included fieldnotes and transcripts of interviews. Reports of these data were included in three previous semiannual progress reports. A synopsis of these results is given below in the form of 12 major assertions about the character of science teaching and the environment in which it occurs:

1. Science teachers are mostly middle-aged males who hold good academic credentials to teach their subjects and who are experienced in science teaching.

2. Rapport between science teachers and students is on the whole friendly. This creates a congenial relationship between teachers and students both inside and outside classrooms.

3. Science teachers have a high degree of autonomy in determining instructional content and academic standards. For all practical purposes, each teacher can determine what to include and exclude from classroom discussion in spite of the fact that a specific textbook has been officially adopted for use in nearly all classes.

4. Many science teachers devote a significant part of their efforts and time to activities that are unrelated to science teaching like coaching, external enterprises and activities related to church or community organizations. Some have their own businesses or work outside of school.

5. Rapport between science teachers and administrators varies considerably but their interactions tend to be superficial. In most cases observed, there was a lack of interaction between science teachers and administrators about matters relating to curricular choices and instructional decisions.

6. Science teachers perceive their role as presenters and organizers of information. Diagnosis and remediation in cases where students experience difficulties in learning subject matter were not observed in classrooms and were not discussed by science teachers when they talked about their work or role conceptions.

7. Science teachers perceive their work as more demanding than that of teachers of other subjects. This is seen as the result of the nature of science and science learning which requires more efforts on the part of both the teacher and the learner.

8. Science teachers rarely discuss teaching strategies, student learning problems, or other pedagogical matters with each other.

9. Most science instruction is inappropriately contextualized. Teachers rely very heavily on textbooks, and they seldom make clear connections between the content of these books and students' daily life. In cases where instruction is appropriately contextualized, students' attentiveness and participation change drastically.

10. In most secondary science classes, 5-7 outgoing, able students engage in more than half of the dialogue between teachers and students. Moreover, it is this group of students who determine the pace of instruction in science classes. The remaining 20-25 students are passive participants in an environment that nurtures a few students and leaves the majority of students with limited interaction, understanding, and self-esteem.

11. Science instruction proceeds with little disruption in most classes; however, the standards of behavior set by teachers varies considerably. Overall standards of academic performance in science are low and provide relatively little challenge or practical utility to many students.

12. Secondary science teachers appear to have made their job easier than it really is. Reliance on target students of high motivation and ability to guide pacing provides teachers with a false sense of accomplishment. Minimizing the diagnostic-remedial component of their teaching role and emphasizing their role as managers of instruction and presenters of information make their work easier. Emphasizing recall and deemphasizing the nurture of higher order thinking skills further reduce the demands of their jobs. Reliance on texts as the basis of organization for instruction and belief that "good students will learn and the rest will not" shifts responsibility from themselves and places the burden on students. All of this add up to a "culture of secondary science teaching" that accepts and justifies little or no planning as well as low standards of expectancy. Moreover, there are no incentives or checks and balances within the organizational structure of schools to move science teaching out of this position.

Activities During the Current Period: April-September 1986

During the final six months of this two-year project, staff members engaged in a range of activities designed to consolidate our findings, analyze and interpret our data, and plan for adequate reporting of the results of this project. Our activities included (a) writing an extensive profile on each of the 27 teachers whom we observed extensively during the two-year study; (b) interviewing teachers to acquire added data to enrich profile development; (c) videotaping selected classes and analyzing videotapes to enhance our understanding of science classroom interactions, especially in middle schools; (d) intensive meetings of project staff to discuss issues concerning data collection, analysis, interpretation, and reporting; and (e) preparation and distribution of a "Report to Teachers" which explains the results of the study to the participating teachers and invites their reaction to the report.

These activities aim to (a) reconfirm and elaborate the findings in both specific and broad-range investigations during the first year and a half of study; (b) determine the values, beliefs, and understandings held by school personnel that underlie their actions; and (c) expand our understanding of the environment of secondary science teaching through communications between staff members and teachers both on personal and group levels.

To accomplish these varied purposes, our data collection during this period has included 134 classroom observations, 37 teacher interviews, and 35 other formal interactions as shown in Table 1. The total scope of our data acquisition by eight staff members as we complete the second year of study now includes over 1000 classroom observations, 250 teacher interviews, and 100 other

Table 1

School Data Sources (April 1, 1986-September 30, 1986)

Site/Event	Village		City	
High School	Observations (O) and Interviews (I)*			
	O	I	O	I
Biology 1	12	3	-	2
Biology 2	-	-	-	-
Chemistry 1	4	1	2	2
Chemistry 2	-	-	-	-
Physics 1	7	3	-	-
Physics 2	-	-	3	2
General Science	6	2	-	-
Physical Science	3	2	3	2
Biology for low achievers	-	3	-	-
Middle School				
Grade 8	7	1	44	7
7	7	1	20	3
6	-	-	16	3
Totals	46	16	88	21

Other

Interviews with administrators	4	4
Planning meetings with administrators	5	2
Planning meetings with teachers and administrators, together	20	-
Videotapes of classes	-	10
Teacher profiles	18	9

*Estimated number of classes observed and interviews with teachers.

formal interactions with faculty and administrators at meetings, workshops, and other activities.

An activity that needs special mention is the supplemental interviewing of teachers during this period. This was intended to complement our assertions from classroom observations in the light of information formally expressed by teachers. These interviews helped us validate our assertions through detecting consistencies and/or discrepancies between classroom observation data and teacher interview data. The results helped us understand the values and beliefs related to teaching and learning held by teachers from their perspectives. Eighteen of the twenty-seven participating teachers were interviewed.

Data from the previous 18 months of observations and interviews, supplemented by the additional interviews mentioned above, were used to formulate a profile on each teacher in our study. The profile contained the following topics, organized in a systematic manner, keyed to the extensive data base: (a) educational background, (b) reasons for entering teaching, (c) role conception, (d) expectancies of students, (e) view of learning and teaching (f) attitudes toward students, (g) attitudes about instructional content, (h) characteristic teaching approaches, (i) grading practices, (j) interactions with administrators and peers, (k) professional growth activities, (l) Other nonteaching commitments, and (m) satisfactions and frustrations.

Another activity that also needs special mention was the report of findings of the study to participating teachers. Because the study used ethnographic methodology, we had been vague and noncommital in response to teachers' queries about the results of the study. Now, at the end of the study, as a way of showing our appreciation for their cooperation we distributed a report to share the findings of the study and help them improve their teaching. As a response to the report, several teachers expressed their hopes to discuss the findings with staff members. Follow-up communications will be conducted according to teachers' needs either individually or in groups. This report described our observations of classrooms and the milieu of science teaching in nonjudgmental terms. It also attempted to balance project staff members' viewpoints with teachers' perspectives (e.g., "outsiders'" views with "insiders'" views).

New Findings

During this six-month period, classroom observations, analysis of videotapes, interviews, and preparation of profiles on teachers have resulted in formulation of the following assertions:

Assertion 1. School policies and science teachers' practices discriminate against Black and Hispanic students in ways that are not intended.

In a study of citizenship grades awarded by science teachers in City Middle School, it was found that Black students received poorer grades in citizenship than White students. For example, in one class, 70% of the Black students received low citizenship grades. The reasons for this situation are complex. Teachers' expectancies regarding classroom deportment appear to coincide with

White students' behaviors but are dissonant with the cultural norms of behavior of many Black students. Differences regarding acquiescence of students and oral response patterns were noted. Yet teachers believed that they were dealing equitably with students. Thus, a Black student who called out across the room to a friend during a laboratory session was marked down in citizenship whereas a White student who quietly sauntered over to and talked with a friend was not. Teachers stated that the Black student was disruptive and that their assignment of a low citizenship grade was justified.

Whereas these differences are, in themselves, problematic, a more serious problem arose from school policies regarding citizenship grades. City school policy requires that students with low citizenship grades not to be allowed to participate in specified activities including school camping--a weeklong program that includes science, nature study, recreational, and craft activities at City District's Outdoor Education Center.

As a consequence of this policy, an inordinately larger portion of Black students than White students were precluded from attendance at school camp because of low citizenship grades. Not only were students excluded from the learning that potentially might have occurred, but the action eliminated the opportunity for students and teachers to build rapport and mutual understanding which often derives from intensive interactions over several days in the school camp setting. Moreover, being excluded from such an activity could only deepen animosity between these students and their teachers.

Looking more deeply at the ways in which teachers treat different students differently, we found two major types of differential treatment of students:

1. Earlier work showed that 5-7 "target students" in nearly every class are participants in over 50% of the teacher-student interactions. Further we found that 3-5 students rarely interact with the teacher, and the remaining 20 students (approximately) are called on by the teacher once or twice a day.

   Target students benefit both cognitively and affectively from this interaction. They receive the majority of the teacher's attention and are participants in the majority of verbal discourse between teachers and students. Few Black or Hispanic youths are included as target students even though about 40% of the City school population is Black and 10% is Hispanic.

2. We also found that the same teacher will treat different classes differently. In City Middle School, students are tracked into either of two levels of classes according to reading achievement. The most able readers are placed into "enriched" classes that concentrate the top 25% of the students together in a class. The remaining 75% of the students are in "regular" classes in which the average performance level consequently was reduced as had been teachers' expectancies of these classes.

Typically, teachers were assigned one or two enriched classes with the remainder of their five-period day (three or four classes) being with those students placed in "regular" classes. Teachers' comments about the differences between the "good" students in enriched classes and poorer students in regular classes was evident in a large proportion of the interactions among City Middle School faculty and between them and members of our project staff. In addition, observations in classes showed that the interactions between students and teachers differed in regular and enriched classes. Students in enriched classes were more cooperative than students in regular classes. Teachers responses to student behaviors in regular classes tended to increase tension between teachers and students creating a strained atmosphere, whereas the atmosphere in enriched classes was more conducive to productive interactions.

It appeared as though there was agreement between teachers and students in enriched classes about purposes of instruction and the ground rules for daily operation of the classroom. In contrast, there seemed to be a tension between teachers and students in regular classes on nearly every count including ground rules of classroom operation, standards of work in class, homework, and interpersonal interactions.

Two points seemed especially problematic about the observed situation: First, the most striking difference between regular and enriched classes were their racial constitution. Enriched classes contained a majority of White students while regular classes contained a higher portion of Black students. Moreover, the classes that teachers perceived as being most difficult contained an inordinately larger proportion of Black males. This was disturbing because assignment of students to enriched and regular classes was determined by constitutive rules developed and applied by teachers and administrators, a majority of whom are White.

Second, there was no recognition by the teachers that their difficulties in working with students in the regular classes was anything more than a student problem. Recurrently, teachers alledged that the students lacked motivation, interest, intelligence, and parental support necessary to be successful in learning science. Teachers uniformly dismissed any responsibility for the behavior and achievement of these students. Students' questions about the utility of the curricular content or the value of instructional approaches also were not taken seriously by teachers. Unfortunately, without recognition that they as teachers have some responsibility to alter the extent stituation, improvement is unlikely to occur.

The long-term effect of this set of circumstances was demonstrated blatantly in June when 34 graduates from City schools were honored for their achievements in a section devoted to graduates in the local city paper. The list contained one Black female and one Hispanic male even though about 50% of the school population are from these ethnic groups; however, our project staff has seen no evidence that this set of circumstances and those described in the middle school are the result of willful discrimination. Rather, it appears to be an unintended consequence of a complex array of issues including a difference in values and expectancies between White middle-class teachers and students from ethnic minorities. Moreover, this problem seems to affect more than students from ethnic minorities; it may affect all students who are not part of the "target student group."

In closing, we hasten to point out that project staff members did not set out to uncover this finding. Rather, our observations of interactions among students, teachers, and administrators brought us to an initial comprehension of differential treatment of students that has a racial/ethnic quality. Our observations do not suggest intentional discrimination. The issue is more subtle. We raised this issue because it is an important one which needs attention. Blacks and Hispanics have been and still are under-represented in technical and scientific careers. Over the past two decades, efforts at increasing their access to these careers have had little effect. Our findings may engender insights and potential research questions regarding this issue.

Assertion 2. There is a discrepancy between classroom practices of teachers and their descriptions of their work.

Our observations and interviews have shown that most teachers tell a better story about teaching than they deliver! Teachers tend to describe their teaching practices in terms that differed from what we observed in their classes. We observed a strong emphasis on recall and on textbook-centered instruction. Teachers said they were teaching students critical thinking skills and how to reason from scientific principles. They said that they were going beyond their textbooks to provide students with applications of knowledge to daily life. Most felt their instruction was well planned and lucidly organized. Our observations showed that teachers did little planning and that lessons lacked sound logical sequence. Most teachers felt they were doing an effective job of teaching and that problems they faced lay beyond their control, arising from poorly motivated students, lack of equipment, lack of sufficient preparation and planning time.

The reasons for this discrepancy may partly be semantic and may partly lie in teachers' perception of their role. In designing homework and seatwork for students, teachers, using textbooks as a guide, include some questions that require students to think critically or reason from scientific principles. Many students, however, answer their questions simply by copying phrases which contain the "right words" from the text, but which may or may not answer the questions adequately. Teachers believed that they had set up conditions in which students could learn their higher order thinking skills, whereas the students found a way to circumvent this requirement by altering the task.

Moreover, regarding role perception, teachers saw their role as presenters of information and organizers of instruction and did not perceive diagnosis and remediation as central to their role. Thus, they were willing to accept that only the most able students would be able to use higher order thinking skills. They did not even attempt to determine if students were having difficulty with particular tasks and consequently did very little to help students develop the techniques and skills that would be essential for more than rote recall of factual knowledge. Because of this viewpoint, rote recall has become the acceptable standard of performance in most science classes.

Assertion 3. Secondary science teachers perceive their primary role as managing classrooms; presenting scientific knowledge to their students is also an important part of their perceived role.

Our observations, interviews, and casual conversations continuously have reinforced these points about teachers' perceptions of their role. As stated earlier, diagnosis and remediation are not part of teachers' self perceived role.

Teachers' emphasis in classroom management, in turn, places a priority on students' behavior. This has resulted in "integration" of students' achievement and citizenship in some cases and appeared to be part of the issue underlying the unwitting discrimination described in Assertion 1.

Assertion 4. Teachers believe that the quality of their work is high and that little improvement is possible without added resources or altered conditions.

During interviews and discussions, teachers responses to two questions gave rise to this assertion. In response to questions about how science instruction could be improved, teachers suggested more time for planning and more resources for supplies and equipment. Implicit in the teachers' comments is an equation of quality teaching with "hands-on" experiences in science; however, in reality, we observed relatively little laboratory-centered teaching, with lack of equipment and facilities being the characteristic excuse for using other approaches.

These beliefs and constraints (more imagined than real) notwithstanding, teachers allocated responsibility for improved motivation and better achievement to students and their parents. In short, teachers were unwilling to recognize that they have a stake in bringing about improvements in students' achievement and motivation in science. When confronted with societal concerns about contemporary science instruction, teachers gave two simultaneous reactions: First, they were pleased that more money might be forthcoming for science instruction. Second, blame for the conditions were attributed to all quarters except to teachers.

When asked what added resources should be spent for, responses included (a) better salaries for teachers, (b) more equipment for teaching science (generally expensive items such as microscopes, balances, LASERS and computers) and (c) smaller classes. There was no mention of need for reform to make the curriculum more useful to students nor the need for teacher training to make current teachers more effective.

Our second question to teachers was, "How may we (project staff) help improve instruction?" Even in cases where we tried to lead teachers to considering help with instructional management, increasing student engagement, and other pedagogical matters, teachers did not express need for improvement of their teaching skill. Most said straightforwardly that they believed they were good teachers.

Assertion 5. Secondary science teachers appear to have limited vision about their role and future directions for their work.

Teachers agreed that the future world in which today's youth will live as adults will be quite different from the past and present, but when asked how their science program might be altered to better prepare students for the future, teachers had few new ideas. Most said that students would need more science and more knowledge about computers; however, concepts such as ability and propensity for continuous learning, higher order thinking skills, and other similar ideas were notably absent from their replies.

Science teachers appear to be "locked into" their present status. They appear to view it from an egocentric perspective. Their out-of-school activities generally are quite unrelated to science teaching. Other than some television viewing of science-based programs like NOVA, they receive little input about their profession. Few read professional journals to keep up to date with either scientific knowledge or pedagogical developments. Few now go back to school because they have satisfied the professional development requirements for certification.

Interestingly, most teachers say that they would like to engage in additional professional development activities, but they decline to do so unless they are paid for their time and effort. Moreover, few teachers appear to be willing to engage in serious profesional development efforts even when paid. It seems that they want professional development to result from a short, easy workshop that would last only a few hours. The cluster of practicing teachers that we have been studying not only appears to have made their own job of teaching easier than it really is, but they also expect their own professional improvement to be effortless. This is an interesting dichotomy: Teachers place responsibility for learning onto their students, but do not accept responsibility (and accompanying effort) for their own learning and professional growth.

Assertion 6. Many secondary science teachers feel trapped and unappreciated in their job.

For many of the teachers, secondary science teaching was not their first choice as a career. For a few, their reassignment to teach science is recent (e.g., the last 2-5 years) and some of these newly assigned teachers have not accepted their new career. As a result, their emotional energy appears to be directed toward "fighting the system" that put them in a job that they do not want. For many others who have been teaching science for several years, their candid personal interactions with project staff suggest that higher paying, more prestigious careers as engineers, physicians, or scientists were unattained goals. Science teaching was, for many, a second (or third) choice when other options were not achieved.

Initial apprehensions about their career have been reinforced by perceptions that their efforts are not appreciated. Administrators, parents, and many students give them little positive feedback. Many teachers develop very cordial rapport with students, which provides both them and their students with positive reinforcement. Nearly all teachers state that it is the rewards they get from students that make their job worthwhile; however, lack of recognition from adults including parents and administrators is a major factor in teachers' disenchantment with their work.

Much of the success of our staff during this project may have arisen from our ability to meet an unfulfilled need for many of the 27 teachers in our study--that being the need for interaction with and approval from significant adults. Each of our project staff members was accepted by the teachers and taken into their confidence as this project devleoped. This was essential for successful ethnography. It also appears that our presence in the school has become important to many of the teachers as a form of professional contact and prestige.

Assertion 7. Secondary science teachers demonstrate a high level of resiliency.

For three years now, we have observed the "erosion" of teachers' enthusiasm, energy and, spirit throughout the year as they engaged, week after week, in their self-imposed rapid-fire schedules. By March, teachers appear to be ready for vacation. Spring break, which is one week long, appeared to provide some relief. On the other hand, summer break, and the prospect of new students and new challenges, seems to be energizing to teachers.

Teachers begin each new school year with a high level of enthusiasm and a new resolve. Most return to school with specific ideas about new activities they will employ with their students. They have plans for more effective organization and management. There is optimism that the new "crop" of students will be better than the last one. Unfortunately, however, this optimism does not appear to be accompanied by acceptance that their new students will lack the knowledge, attitudes, skills, and maturation that was engendered with such effort in the last group! As a result, their initial enthusiasm is offset by the realities of their work and the demanding schedules they have set.

Assertion 8. Many teachers are frustrated by conditions over which they have little or no control and fail to act concerning matters which they can influence.

In nearly every discussion we held with teachers, some allusion was made to societal factors that influence students adversely, including family instability, teen drug use and alcoholism, and uncertainties about employment in the future when the students enter the workplace. These conditions were lamented, with a degree of resignation; however, teachers rarely made any allusion to their role in rectifying any of these problems even in instances where they were taking positive actions or effected positive influence. For example, the male teachers (comprising the majority of secondary science teachers) did not appear to recognize that they may have served as significant male role models for youths from homes in which the father was absent. Nor did they suggest that more effective teaching of higher order thinking skills might be a key factor in enhancing employment possibilities for students after graduation. Moreover, few teachers even hinted that their efforts could help students develop the motivation and skills needed to break away from an environment of poverty and a dim future. Attention to factors over which little control can be exercised while ignoring central matters regarding effective role fulfillment appears to by symptomatic of teachers' feelings of poweressness.

These eight new assertions represent extensions of our understanding of the character of secondary science teaching and the forces which shape it. They add to assertions already available in prior reports. They are supported by our rich data base and they serve as the foundation for our spin-off projects and future activities which are described in the following section.

Spin-off Projects

Sequencing in Secondary Science Teaching (SSST)

This project is a newly developed study supported by the MSU All-University Research Invitiation Program. The rationale for the SSST project is that students' potential for comprehending science may be inhibited by deficiencies in the logical organization and sequence of science instruction. From our studies during the past two years, it appears that classroom activites, labs, films and homework lack logical coherence which may be a contributing factor in difficulties many students experience when attempting to understand scientific concepts, principles, and relationships. The purposes of this proposed research are to (a) conduct a pilot study of logical organization and sequencing of two instructional units in secondary school science as taught by two teachers, (b) interview the teachers regarding their understanding of the subject matter and its presentation, (c) formulate techniques for analyzing the logical organization and sequence of instruction, and (d) utilize data from the pilot study to prepare a proposal to the Science Education Directorate of the National Science foundation for an extended study of the logical organization and sequencing of instruction to maximize student learning in science.

A Study of Sequencing of Instruction in High School Physics

This project will examine how three physics teachers construct a sequence of events to help students understand the concepts and principles included in an instructional unit on kinematics. The study will describe the flow of information as presented by the teachers during lectures, recitations, demonstrations, laboratory experiments, and through reading materials and homework. The study involves the observation of three high school physics teachers teaching in three different schools and is the basis for Armando Contreras' dissertation.

A Study of a Physics Teacher's Personal Practical Knowledge

A teacher's knowledge of subject matter and pedagogy combined with their beliefs and thoughts about teaching has been labeled teachers' personal practical knowledge. At present, we know very little about the personal practical knowledge of physics teachers. Using qualitative methods, Ribhi Abu-Isneineh will study one physics teacher, using a second physics teacher as a "sounding board" to enrich understandings. This research will constitute dissertation.

Instructional Materials Development Consortium

This project is aimed at formulation and implementation of a yearlong science course for high school youth who are in the lower 50th percentile on achievement and motivation. Teachers and administrators from three school districts, with the help of staff members from Michigan State University, the UAW/GM Human Resource Center, and the American Medical Association are working together to (a) review available research data and practical knowledge on effective teaching of youth in the target population; (b) examine extant instructional resources for teaching science and technology available from business and industry, educational publishers, and private organizations; (c) formulate instructional modules based on (a) and (b) which will comprise a yearlong science course for youth in the target population; and (d) plan and initiate testing of this course of study in the three cooperating districts during the 1986-87 academic year. The project is a cooperative project between Michigan State University and three area school districts funded by the Education for Economic Security Act.

School-Based Instructional Materials Development

The school-centered project is aimed at formulation and improvement of a yearlong science course for high school youth who are in the lower 50th percentile on achievement and motivation. Teachers and administrators from the Grand Ledge school district, with the help of staff members from Michigan State University will work together to (a) review available research data and practical knowledge on effective teaching of youth in the target population, (b) examine extant instructional resources for teaching science and technology available from business and industry, educational publishers, and private organizations, (c) modify existing instructional modules and create new activities to formulate a yearlong science course for youth in the target population, and (d) plan and initiate testing of this course of study in the Grand Ledge School district during the 1936-87 academic year. This project is funded by the Education for Economic Security Act.

Papers Proposed for Presentation at Professional Meetings

Annual meetings of American Educational Research Association and National Association for Research in Science Teaching are scheduled for March and April. Three papers have been proposed by project staff members for AERA and five have been proposed for NARST.

Conclusions and Future Directions

This study of the milieu and character of secondary science teaching has continued for two years. As a result of it, we know much more about the nature of secondary science teaching and the forces which shape it than we did when we began. We have a large volume of data from classroom observations, interviews and discussions with school personnel, and review of school documents. We have formulated more than 20 major assertions about the character and quality of practice in school science. A new study of the logical sequence of instruction in secondary science has been initiated as an outgrowth of the study. Two significant dissertations and two instructional materials development projects also are byproducts of it. These five new projects were derived from and are enriched by the insights and understandings provided by the Secondary School Science Project.

Whereas all of these outcomes and derivatives are important, the fundamental significance of the data about school practices in secondary science must be highlighted. There now exists field notes from over 1000 classroom observations, 250 formal interviews, and 100 meetings at which project staff members were participant observers. These data are available and they need to be "mined" to draw added meaning from them. It is, therefore, the senior investigator's intent and plan to devote research time (e.g., approximately 50% of effort) during Winter, Spring, and Summer 1987 to preparation of a monograph based on this project. The findings are important and timely and need to be reported more fully than has been possible to date.

To accomplish this effort, project staff members will continue to meet with me on a voluntary basis to provide input and reaction to outlines and drafts of this monograph. It is hoped that a publishable draft will be completed within a year.

In addition, the following papers were presented at the annual meeting of the National Association for Research in Science Teaching, held in San Francisco in March 1986:

Cline, D.A., Target students in a science classroom: A case study.

Contreras, A., The decontextualization of middle school science: An ethnographic study of three teachers.

Gallagher, J.J., A study of secondary school science teaching practices.

Lee, O., & Gallagher, J.J., Differential treatment of individual students and whole classes by middle school science teachers: Causes and consequences.

Isneineh, R.A., High school science teachers' role conceptions as reflected in their daily classroom practices and discussions.

CLASSROOM STRATEGY RESEARCH

The Classroom Strategy Research program is concerned with teachers' thinking about and strategies for managing their classrooms and motivating and instructing their students. It has engaged in two major lines of work. The first line has involved conceptual work and research synthesis on classroom management in general, and, in particular, empirical study of teachers' perceptions of and strategies for coping with students who present chronic emotional or behavioral problems. The second line of work involves conceptualization and research on student motivation to learn and, in particular, on how teachers can affect the development of such motivation in their students by modeling, projecting expectations and attitudes, and otherwise socializing their students' perceptions of and responses to academic tasks. Two naturalistic studies of how students respond to teachers' comments about academic tasks have been completed. The present proposal calls for extending this line of work by developing and then experimentally testing systematic procedures that teachers can use to increase their students' motivation to learn.

Jere Brophy (coordinator)
Rick Bevis
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Stephanie Gregg
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CLASSROOM STRATEGY RESEARCH

The Classroom Strategy Research Project considered teachers' thoughts and actions (in short, their strategies) for handling certain enduring problems of teaching practice. Two distinct lines of research were pursued within the project: (a) the Classroom Strategy Study, an investigation of teachers' strategies for coping with students who have chronic personal or behavioral problems, and (b) student motivation studies designed to identify strategies that teachers can use to stimulate their students' motivation to learn the content or skills that academic activities are designed to teach.

Classroom Strategy Study

This study involved interviewing 98 elementary school teachers about their perceptions of and strategies for coping with each of 12 types of problem students (low achievers due to limited ability, underachievers due to perfectionism, underachievers due to lack of interest in or alienation from school work, underachievers due to failure syndrome or learned helplessness, hostile-aggressive against peers, defiant against the teacher, passive-aggressive against the teacher, distractible, hyperactive, immature, shy/withdrawn, and rejected by peers). For each problem student type, each teacher responded to an open-ended interview designed to elicit the teacher's general strategies for coping with the type of problem student under consideration, as well as to two vignettes designed to elicit the teacher's responses to specific behavioral incidents representative of the management problems that that type of problem student typically presents in the classroom. The teachers' responses to the interview and vignettes were recorded, transcribed, and coded, and scores developed from the coding were analyzed for general trends observable across the sample of teachers as a whole as well as for differences between teachers working in the early grades (K-3) and those working in the later grades (4-6), differences between teachers working in a small city school system and teachers working in the inner-city schools of a large metropolitan system, differences between teachers whose role definitions stress instructional goals and teachers whose role definitions stress socialization goals, and differences between teachers rated as more effective and teachers rated as less effective in coping successfully with problem students.

General trends in the findings (that is, findings that were not specific to particular problem student types) were described in the previous progress report. In the present report, we will summarize the highlights of a recently completed 125-page presentation of the findings concerning one of the specific problem student types--students who are hostile or aggressive toward their peers.

Hostile-aggressive students were described to the teachers as follows:

> These children express hostility through direct, intense behaviors. They are not easily controlled.

1. intimidates and threatens
2. hits and pushes
3. damages property
4. antagonizes
5. hostile
6. easily angered

For the general strategy interview, the teachers were asked to describe their strategies for coping with any such hostile-aggressive students that might be assigned to their classes. In addition, the teachers were asked to respond to the following two vignettes by stating exactly what they would say and do in response to the events depicted:

> A. This morning, several students excitedly tell you that on the way to school they saw Tom beating up Sam and taking his lunch money. Tom is the class bully and has done things like this many times.
>
> B. Class is disrupted by a scuffle. You look up to see that Ron has left his seat and gone to Phil's desk, where he is punching and shouting at Phil. Phil is not so much fighting back as trying to protect himself. You don't know how this started, but you do know that Phil gets along with the other students but Ron often starts fights and arguments without provocation.

Few if any of the teachers had had specific preservice or inservice training in strategies for coping with hostile-aggressive students, so that their responses to the interview and vignettes reflected experience-based intuition rather than codified knowledge. They rarely mentioned specific theorists or technical terminology. Nevertheless, most of their responses can be understood and most of the general findings can be described, using concepts borrowed from human development, clinical psychology, and related fields. In this regard, the findings concerning hostile-aggressive students tend to favor the theorizing of writers such as Patterson (1982), Glasser (1977), Good and Brophy (in press), or Rodell, Slaby, and Robinson (1976) who stress resocialization and self-control training over the suggestions of writers who favor less direct methods (nondirective therapy and environmental engineering strategies that do not include confronting aggressive students about their inappropriate behavior, requiring them to accept responsibility and the attendant consequences for it, and trying to instruct them in better ways of coping with conflict and expressing aggression).

Teachers who were rated low in ability to cope with problem students had limited and mostly vague ideas about how to respond to aggressive students. A few of these teachers denied any responsibiity for coping with such students and would attempt to pass the problem on to the principal or other professionals at the school. Most of the rest would rely on help from these sources because they consciously saw themselves as lacking the ability or training to be able to handle aggressive students effectively or because they lacked clear ideas about what to do beyond scolding the student, threatening or invoking punishment, or informing the parents about aggressive incidents. In short, these teachers were not ineffective because they relied on well-articulated but ineffective methods (such as catharsis or physical punishment, for example); instead, they were ineffective mostly because they lacked well-articulated ideas about how to cope with aggressive students and thus ended up responding in ways that were not systematic or powerful enough to change the behavior of these students.

Almost all of the teachers reported that they would at least make statements proscribing aggressive behavior and warning aggressive students against repetition of it. For many of the lower rated teachers, however, this was confined to a brief "talking to." In contrast, the higher rated teachers outlined more intensive and sustained responses. For some higher rated teachers, this meant a severe lecture (sometimes an extended scolding or tirade) designed to make it clear to aggressive students that their aggression was inappropriate and would not be tolerated. More typcially, however, the higher rated teachers responded with equally determined but less emotionally intense socialization that included logical in addition to moralistic rationales for behavior change demands and that included attempts to counsel or instruct the aggressive student in more acceptable ways of dealing with frustration and conflict in addition to attempts to coerce him into stifling his aggressive impulses.

Thus, the responses of the highly rated teachers tended to be both power-assertive and instructive and to be framed within the context of confidence in ability to change the problem student and determination to do so. In contrast, the responses of the low rated teachers were mostly coercive but not instructive and amounted to confused attempts to try to control the behavior of the aggressive students rather than systematic attempts to change them in more fundamental ways.

The coercive elements of the responses of the higher rated teachers to hostile-aggressive students were unusual within this study. For most of the other problem student types, the higher rated teachers stressed instruction, counseling, and other forms of assistance to problem students, but made little or no mention of trying to control their behavior through coercion. However, given that aggression is not merely inconvenient or disruptive but involves physical harm to other students, it is appropriate that teachers take coercive action to curb it, and most of the teachers did mention one or more coercive strategies. It is worth noting, though, that the vast majority of the teachers stressed strategies calling for using the threat of punishment (loss of privileges, informing the parents or the principal, isolation or suspension) to pressure aggressive students into controlling their misconduct. They usually did not mention retaliatory physical punishment or other coercive responses that could be described more as revenge mechanisms or predispositions to inflict punishment for its own sake than as strategies for controlling students who fail to control themselves. This was especially the case for the higher rated teachers, who tended to mention threat of punishment as part of a larger and systematic approach to curbing aggressive behavior and resocializing the aggressive students. Lower rated teachers often placed too much emphasis on punishment as retribution and not enough on curbing aggression by students who were out of control. Thus, it appears that the key to the effectiveness of the coercive aspects of teacher response to aggression is not retribution or even "getting tough" for its own sake, but instead is the contruction of a response that will bring sufficient pressure on the aggressive student to cause him to curb his aggressive behavior.

The key to the instructive part of an effective response to aggressive students appears to be providing these students with counseling or instruction in more effective ways of handling frustration, controlling their temper, expressing anger verbally rather than physically, and solving conflicts through communication and negotiation rather than aggression. Thus, the highly rated teachers tended to respond to aggression as a behavioral problem calling for resocialization of the student's cognitive and behavioral responses to situations in which he was presently acting aggressively. In contrast, these teachers did not treat aggression as if it were a neurotic symptom calling for nondirective counseling or self-concept support. Nor did they treat it as a relatively minor problem that could be handled through brief management responses, environmental engineering, or behavioral shaping using incentives or contracts (although many highly rated teachers mentioned brief management responses or environmental engineering strategies in their interviews as parts of larger overall strategies that would also include actions taken to curb aggressive behavior and resocialize the aggressive student).

Although they were firm in demanding that aggressive students curb their aggressive behavior, the higher rated teachers often were supportive or protective of these students as well. Besides speaking of taking the time to instruct them in temper control and better ways of handling conflict, the higher rated teachers were likely to mention "kid gloves" treatment for these students during tense situations and willingness to let them tell their story before making judgments about their guilt or responsibility in conflict situations (or at least, if guilt had already been established based on other information, to let these students tell their side of the story before taking action). The higher rated teachers also were often willing to allow aggressive students to ventilate their anger verbally, although they did not encourage these students to achieve catharsis by acting out their anger physically against substitute objects. The data provided no evidence to suggest that the catharsis approach is effective and some to suggest that it is counterproductive.

Several strategies that are commonly recommended to teachers as methods of responding to problem students were not mentioned often in the teachers' responses to the interview and vignettes dealing with hostile-aggressive students and did not have consistent significant correlations with effectiveness ratings. These included insight-oriented counseling, behavioral shaping through incentives or contracts, extinction through ignoring or time-out procedures, and providing encouragement to the student by developing a close personal relationship and supplying self-concept support. These approaches all appear to be too limited or indirect to be effective against a problem as serious as chronic aggression, although they may be effective for less serious misconduct problems or for symptoms that are more neurotic than behavioral.

Class meetings, Magic Circle activities, and related group meetings techniques also were not mentioned often and did not correlate significantly with effectiveness ratings, even though these techniques do appear to be appropriate as responses to aggression. They were mentioned often enough to allow a significant relationship with effectiveness ratings to appear if it did exist, however, so that the lack of support in the data is due to a lack of consistent relationship with effectiveness ratings and not merely to infrequent mention. Thus, the data indicate that most teachers either do not know about such techniques, or do not find them useful or worth the trouble, and that the teachers who do use the techniques do not consistently achieve better results than other teachers. This might simply mean that group meetings techniques are not especially effective, although it is also possible that the teachers who used these techniques did not use them in ways that their proponents envisioned them being used (There were some indications of the latter problem in the data. In particular, certain teachers appeared to use class meetings more as occasions for generating peer pressure against hostile-aggressive students than as occasions for deepening their insight and helping them to learn better ways of coping with conflict or frustration).

Underlying many of the differences between the highly rated and the lower rated teachers in strategies mentioned as responses to aggressive students was a pervasive difference in sense of efficacy or confidence in ability to effect change in such students. The lower rated teachers often implied or even stated directly that they were powerless to effect significant change in aggressive students, but the higher rated teachers usually expected to be able to achieve significant improvement through their own personal efforts. Their rosier expectations often even included a degree of perceptual distortion--in responding to the two vignettes, many of the higher rated teachers spoke about Tom or Ron as if their aggressive behavior were less chronic or severe than it had actually been portrayed in the vignette. Up to a point at least, these distortions of objective reality in the direction of optimism and positive expectations are probably adaptive because they cut the scope of the problem down to "doable" size and allow the teachers to undertake with confidence projects that they might undertake only half-heartedly or not at all if they dwelled on the odds against them. In other words, self-fulfilling prophecy effects of teacher expectations are probably operating here (in addition to the effects of outcomes on expectations that operate in the opposite direction--it is to be expected that teachers who are more effective in coping with problem students will view a given problem as less severe and feel greater confidence in being able to cope with it successfully than teachers with smaller skill repertoires and less successful track records).

The same general principles for effective response to aggressive behavior appeared to hold in both the early and later grade levels and in both the small city and the inner-city metropolitan schools. However, there were some differences in emphasis. In particular, teachers in the early grades, especially those working in the small city, could use relatively weak and indirect strategies (brief management responses, minimum interventions, environmental engineering) in addition to and to some extent instead of the more direct and powerful interventions that were needed in the upper grades. In the small city, where teachers tended to encounter less frequent and severe forms of aggression, positive correlations with effectiveness ratings were seen for suspending judgment in order to hear both sides before determining guilt or responsibility for aggressive incidents and for various supportive or protective strategies mentioned in addition to strategies involving coercion or resocialization of the problem student. These supportive or protective strategies were less likely to correlate positively with effectiveness ratings for teachers working in the inner-city schools of the metropolis, where the most consistent correlates were those suggesting the importance of taking strong and effective action to curb aggressive behavior. This was especially the case in the data for Vignette A, in which robbery of Sam's lunch money by Tom suggested incipient criminality ("protection racket" activities, for example) in addition to physical aggression as such.

Involving the parents (in positive ways, not just by informing them about aggressive incidents with the intention of motivating them to punish their child) also was correlated more closely with effectiveness ratings for teachers working in the inner-city metropolitan schools than for teachers working in the small city. Thus, the big city data underscore the importance of two factors--school safety and parental involvement--that also have been mentioned frequently as factors that enhance the effectiveness of schools located in inner-city neighborhoods (Good & Brophy, 1986).

As far as they go, the data provide support for strategy training, cognitive behavior modification, and related approaches that call for providing information and instruction to aggressive students that will increase their metacognitive awareness of their thoughts and actions during interpersonal conflict situations and will enable them to exert better cognitive control over their behavior. None of the teachers mentioned these techniques or their proponents by name, and none supplied a complete, integrated, and sequenced description of the application of such techniques. However, those elements of the responses of highly rated teachers that involved instruction or resocialization of aggressive students flowed from the same basic ideas that underlie strategy training and cognitive behavior modification techniques, even though the teachers were speaking from experience-based intuition rather than codified knowledge.

Along with the general pattern of findings concerning effective response to hostile-aggressive students, this fact suggests that (a) strategy training and cognitive behavior modification techniques (along with whatever coercive techniques may be necessary to curb aggressive behavior) appear to be more promising than either traditional reinforcement-oriented behavior modification techniques or counseling techniques developed by psychotherapists working primarily with neurotic problems as strategies for teachers to use with hostile-aggressive students; and (b) given that highly rated teachers appeared to be already achieving some success using methods that flow from the same basic ideas, teachers should be especially amenable to training in these techniques and should find them more effective with hostile-aggressive behavior and more feasible for use in the classroom context than the more traditionally recommended reinforcement or psychotherapy techniques.

In theoretical terms, the data suggest that chronic hostility and aggression should be viewed primarily as a behavioral problem calling for resocialization of undesirable predispositions acquired through conditioning and social learning mechanisms rather than as a neurotic problem calling for therapuetic intervention designed to reduce inner conflict or develop insight. Within the social learning or behavioral approach, however, the data also suggest that aggression should not be viewed solely as a problem of behavioral excess calling for clearly stated limits backed by reinforcement, punishment, or extinction mechanisms. In addition, it also should be viewed as a problem of cognitive deficit calling for modeling and instruction designed to acquaint hostile-aggressive students with better ways of responding to frustration or conflict and to equip them with the cognitive and metacognitive skills that they will need if they are to learn to curb aggressive impulses and rely on more effective coping mechanisms during real life frustration or conflict situations.

This information on teachers' strategies for coping with hostile-aggressive students will be disseminated through the IRT Report Series and through articles in journals serving educational psychologists, school psychologists, teacher educators, and teachers. Similar reports and articles will be prepared concerning strategies for coping with each of the 11 other types of problem students addressed in the Classroom Strategy Study. Finally, a lengthy monograph summarizing and integrating the findings from the study as a whole will be prepared for publication as a book.

Student Motivation Research

Based in part on earlier work on teacher praise (Brophy, 1981) and teacher expectation effects (Brophy, 1983c), much of the recent work of the Classroom Strategy Research Project has concentrated on the topic of student motivation and in particular on identifying strategies that teachers can use to stimulate their students' motivation to learn. Student motivation to learn is defined as a tendency for students to take classroom lessons and assignments seriously and to attempt to get the intended academic benefits from them. Students who are motivated to learn will concentrate on acquiring knowledge and mastering skills, not merely on meeting requirements.

Work on the topic began with literature review and conceptual analysis designed to sharpen the conceptualization of student motivation to learn and to differentiate it from related concepts such as achievement motivation and intrinsic motivation (described in previous progress reports and in Brophy, 1983a, 1983b).

Briefly, although it fits within the traditional expectancy x value conceptualization of motivation (Feather, 1982), the present conceptualization and program of research on student motivation to learn differs in emphasis in several respects from most of the work done by social learning theorists and attribution theorists within the expectancy x value formulation. First, it emphasizes covert events occurring during original learning rather than the more overt behaviors that occur during later performance based on that learning. Also, it focuses specifically on learning in the classroom setting and thus assumes that most of the learning involves covert cognitive activities leading to conceptual change rather than overt physical activities leading to the development of behavioral skills. Thus, rather than being confined to consideration of strategies for getting students to try their best when taking tests or responding to other performance demands that require them to apply previous learning, the present approach also emphasizes strategies for stimulating students to activate desirable cognitive and metacognitive skills (information-processing and sense-making strategies, comprehension-monitoring and repair strategies, self-monitoring of progress toward consciously adopted task mastery goals) that are associated with high-quality engagement in academic activities.

In addition, the present approach emphasizes the value aspects of the expectancy x value conceptualization of motivation, not just the expectancy aspects. In this respect, it complements the contributions of social learning and attribution theorists concerning such concepts as sense of efficacy or competence, sense of covariation between effort and outcome, and attribution of outcomes to internal and controllable factors rather than to external or uncontrollable factors; that is, in addition to considering expectations and attributions concerning success or failure in meeting performance standards (Can I succeed at this task? Why or why not?), the present approach considers students' expectations and attributions concerning task value issues (Why am I engaging in this task in the first place? What am I supposed to get out of it? What are my goals?)

The concept of student motivation to learn has much in common with the concept of intrinsic motivation, but it is somewhat more cognitive and less affective than the latter concept is usually described; that is, the concept of motivation to learn focuses on cognitive engagement in academic activities with emphasis on gaining the knowledge or developing the skills that the activities are designed to impart, whereas the concept of intrinsic motivation typically implies engagement in activities because they are experienced as interesting, enjoyable, or rewarding. Students can (and hopefully will) be motivated to learn even when they are not intrinsically motivated (e.g., if they see the value of academic activities and thus attempt to get the intended benefits from them, even though they do not enjoy the activities). Also, students can (but hopefully won't) engage in academic activities with intrinsic motivation but without motivation to learn (e.g., when they enjoy participating in a classroom game but concentrate on its social or competitive aspects without devoting much attention or thought to what they are supposed to be learning from the experience). Consequently, although it is viewed as desirable for teachers to try to capitalize on their students' intrinsic motivation (insofar as it is compatible with achieving curricular goals, teachers should plan activities that students will find intrinsically interesting and enjoyable), this is not seen as the primary goal of teachers' motivational efforts. Instead, developing the students' motivation to learn is seen as the primary goal.

Working from our definition of student motivation to learn and the related conceptual distinctions just described, we have reviewed the literature to identify and categorize motivational principles that appear appropriate for use by teachers with their students in the classroom (see Appendix for the most recent revision of this listing), and we have conducted three empirical studies. The first of these studies (Brophy, Rohrkemper, Rashid, & Goldberger, 1983) employed naturalistic observation in six intermediate grades (4-6) classrooms to test predictions concerning relationships between teachers' task introductions (what they said about upcoming activities in the process of introducing them to their students) and the quality of student engagement observed during the subsequent activities. As expected, student engagement rates were lower during activities that the teachers had introduced with comments suggesting negative expectations (that the students would not enjoy the task or that they would find it unduly difficult). However, there was no parallel tendency for student engagement rates to be higher during tasks that had been introduced in ways that suggested positive expectations. Instead, the highest student engagement rates were observed on tasks that the teachers moved directly into without first describing them in ways that suggested either positive or negative expectations.

During later debriefing interviews, the teachers who had participated in this study suggested that perhaps they tend to attempt to generate student enthusiasm for tasks only at times when they have reason to believe that things will not go well otherwise (because they know that the task is not intrinsically enjoyable to the students or that the class has become restive). If so, this might produce a tendency in the students to discount or reject teachers' attempts to create positive expectations or attitudes about classroom activities. To assess this possibility, we undertook a second empirical study, done as a dissertation by Neelam Kher (1985), in which elementary school students were asked how they would respond to various examples of teachers' task introductory statements (drawn from the previous study).

Some questions required the students to listen to a pair of sample task introductions and then state which of the two introductions they would rather have the teacher make and explain why. Other questions were more open-ended, asking students what they would think in response to particular task introduction statements or to state what kinds of task introductions teachers could make that would motivate them to try hard on the task. These interview data yielded no evidence of any student tendency to mistrust or discount what their teachers tell them about upcoming classroom tasks (Brophy & Kher, in press). On the contrary, students appear to take teachers' task introductory statements at face value. Thus, there remains every reason to believe that teachers can develop their students' motivation to learn by systematically socializing them through exposure to beliefs, attitudes, and expectations associated with such motivation.

However, both review of research reported by others and analysis of our own classroom observation data suggest that most teachers do not socialize their students in this way very often or systematically. In over 100 hours of observation in the six classrooms observed in our first motivation study, we heard only nine statements made by teachers that could be classified as having potential for stimulating student motivation to learn, and most of these were too vague or sketchy to have much effect. Furthermore, whatever the teachers might have accomplished through these desirable statements about the academic benefits to be expected from engagement in classroom activities probably were undone by much larger numbers of statements that were classified as either controlling or pressuring attempts (stating procedural requirements, demanding that students get busy and concentrate on their work, telling them to hurry up and finish because time was running short, etc.) or as comments likely to engender negative attitudes or expectations about the activities in question (telling the students that the task would be boring, unduly difficult, or problematic in some other respect). Thus, although in theory teachers have a great deal of opportunity to stimulate student motivation to learn in their classrooms through systematic socialization of their students, in practice few teachers seem to be making much use of this opportunity.

Perhaps this should not be surprising, because until very recently, most of what teachers were likely to be taught about motivation in educational psychology and related courses was based on either of the following notions: (a) Learning is (or should be) intrinsically rewarding, so that if a class is not well motivated, there is probably something wrong with the activities that the teacher has selected or with the ways that the teacher presents those activities to the students; or (b) learning in the classroom setting is practically never intrinsically rewarding because students attend school and engage in academic activities because they are required to rather than because they have chosen to and because their performance will be monitored by peers and graded by the teacher, so that it will be necessary to rely on extrinsic incentives such as grades, symbolic rewards, public recognition of accomplishment, competitions, or prizes. These basic assumptions that underlie most of the advice traditionally given to teachers about motivating their students can be seen as both overly extreme and largely contradictory when stated this directly, so it is not surprising that they have left most teachers with either over-simplified (if they follow only one of these ideas) or confused and at least implicitly contradictory (if they try to follow both ideas) notions about student motivation. Furthermore, because neither of these ideas gets directly at student motivation to learn the content or skills that academic activities are intended to develop, it is not surprising that most teachers do not show much evidence of systematic attempts to socialize motivation to learn in their students.

We have addressed this problem by reviewing and synthesizing a broad range of theoretical and empirical literature on the topic of motivation in order to extract a basic set of concepts and principles that enjoy clear empirical support or at least consensual validation by leaders in the field, and within this set, to identify a subset of concepts and principles that appear relevant to the needs of teachers faced with the problem of motivating the students in their classrooms. This effort has so far resulted in a list of approximately 30-40 principles (smaller totals result when certain principles are listed as corrollaries or elaborations of other principles rather than as independent principles in their own right). The latest version of this list is shown in the Appendix, which includes 4 general preconditions that must be in place if students are to be motivated to learn in classrooms, 4 principles for motivating by maintaining students' success expectations, 3 principles for motivating by offering extrinsic incentives for good performance, 10 principles for motivating by capitalizing on students' existing intrinsic motivation, and 14 principles for motivating by stimulating students' motivation to learn.

This list of motivational principles, especially when elaborated to include more information about underlying rationales and supportive evidence, detailed suggestions for and examples of application, and discussion of limitations or qualifications that must be kept in mind, should be a useful resource for teacher educators interested in teaching about and for teachers interested in learning about motivation in the classroom. The list is relatively short and is organized into subsections so that is is relatively easy to learn, and the principles themselves are general enough to have application across a range of academic activities and yet specific enough to serve as useful guides to teacher planning. Additional principles will be added as the literature review and synthesis is completed, but it appears unlikely that the final version of the list will contain more than 45 to 50 principles.

In theory, teachers who had mastered this list of motivational principles (including appropriate elaborations and qualifications) would possess a well-articulated, internally consistent, and apparently powerful conceptual system to draw upon for guidance when designing or selecting classroom activities or attempting to inject motivational elements into their everyday interactions with their students. They would then be in a much better position than most contemporary teachers are to socialize their students' motivational development in systematic ways, and in particular, to stimulate their students' development of motivation to learn.

As a first step in testing this idea, we undertook the experiment described in the previous progress report. Eleven junior high social studies teachers were trained in principles for capitalizing on students' existing intrinsic motivation and for stimulating students' motivation to learn. Emphasis was placed on the strategies for stimulating motivation to learn, especially strategies involving expressing enthusiasm for social studies content and activities, inducing curiosity or suspense, inducing dissonance or cognitive conflict, and making abstract content more personal, concrete, or familiar to the students.

Each teacher was observed teaching two sections of the same social studies class at the same grade level. For the experiment, the teachers were asked to plan their control sections in the usual ways but then to modify or supplement these plans by preparing to teach the experimental section in ways that included something different or extra added for motivational reasons. The teachers kept records describing their planned "extras" in the experimental sections each day. In addition, observers visited the classrooms (both the experimental and the control sections) twice each week from the time the teacher began implementing the treatment through the end of the semester. The observers recorded field notes describing the teacher's introduction to each activity, how the teacher conducted the activity itself, and how the students appeared to respond to it (including periodic counting of the number of students who appeared to be inattentive or off task).

Following their classroom visits, the observers clarified and expanded their notes and prepared comparative notes focused on the similarities and differences between the two class sections observed that day. In particular, the comparative notes focused on what the teacher deliberately did differently in the experimental section that was not done in the control section and on what apparent effects this differentiation had on student motivation to learn the content. The observers also rated the degree of differentiation introduced between the two class sections and the teacher's relative degree of success in addressing cognitive and affective objectives in the two sections.

A specially prepared motivational questionnaire was administered in each class section early and then again late in the semester to provide a pre- and posttreatment self-report measure of student motivation to learn and related motivational variables. Also, achievement data were collected in the form of the students' scores on tests and assignments, and standardized achievement test scores from the previous school year were recorded for use as covariables to adjust student achievement scores obtained during the experimental semester for individual differences in entry level of achievement. Most Classroom Strategy Research Project activity during the past six months has been focused on preparing and cleaning data files and conducting preliminary analyses of these data. Presently available findings are confined to the student questionnaire data; the achievement data are still being prepared for analysis.

The student motivation questionnaire consisted of 46 four-point items. The first 17 of these items presented the students with a pair of statements and asked the students to indicate which of the pair of statements was more true of them and to state whether the chosen statement was "really true for me" or "sort of true for me." The next 27 items presented single statements and required the students to categorize each statement as "very true," "sort of true," "not very true," or "not at all true." Finally, the last two items asked the students to rank their four academic classes (language arts, mathematics, science, and social studies) in order of their importance (How important is what you are learning in these classes, regardless of how much you like them?) and in order of how much they liked them (How much do you like these classes, regardless of how important you think they are?).

Factor analysis of the questionnaire responses indicated that 30 of the items were subsumed under four factors. As expected, one of these was a motivation to learn factor subsuming items tapping the students' concern about making sure that they understood what they were learning and being interested in learning for its own sake and not just to meet school requirements. The other three factors concerned perceptions of the teacher (enjoys teaching social studies, gives examples and tries to make the material interesting, solicits student opinion and allows student choice of activities), conscientiousness and good work habits (student turns in assignments complete and on time, gets started early rather than waiting until the last minute), and interest in and perceptions of the importance of social studies (student enjoys class, finds material interesting, believes that the content is important and will be needed in the future). Pre-post correlations yielded stability coefficients of .65 for total scores on the questionnaire and .45 - .60 for individual factor scores.

Analysis of raw change scores (postscores minus prescores) developed from the student questionnaire data show mixed findings rather than systematically greater gains (or smaller losses) in student motivation in the experimental sections compared to the control sections. Furthermore, contrary to expectation, the most consistently positive gains appeared on items associated with the perceptions of the teacher factor rather than on items associated with the motivation to learn factor. It is not yet known whether these trends observable in the raw change scores will hold up when additional analyses are done to take into account time of day (whether the experimental section was taught earlier in the school day than the control section or vice versa), degree of teacher implementation of the recommended treatment guidelines (teachers varied considerably in this regard), and student achievement level. The results of analyses taking these factors into account will be included in the final report of the study, along with the results of analysis of the achievement data. A report on this experiment will be completed during the next few months and submitted for publication in the Journal of Educational Psychology.

In recent months, information from the student motivation research has been disseminated through the IRT Report Series and through several other mechanisms. Jere Brophy made an invited address on this line of research at the American Educational Research Association meetings in April, made a briefer presentation as part of a symposium on classroom motivation at the American Psychological Association meetings in August and will be making another major invited presentation (the convention's keynote address) at the Northeastern Educational Research Association meetings in October. In addition, chapters describing the work primarily for researchers will appear in two forthcoming edited volumes on aspects of social psychology in the classroom (Brophy, in press; Brophy & Kher, in press), and guidelines for teacher educators and teachers based on our literature review and synthesis work appear in one recently published and one forthcoming textbook (Good & Brophy, 1986, in press). Finally, it is anticipated that a book summarizing in detail motivational guidelines for teachers and teacher educators will be prepared during the coming year.

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Appendix

List of Motivational Strategies Appropriate for Use by Teachers with Their Students.

I. Preconditions for motivating students to learn in classrooms (these must be in place if motivational strategies are to be effective)

- A. Supportive learning environment
- B. Appropriate level of challenge/difficulty
- C. Meaningful learning objectives
- D. Moderation/optimal use of strategies

II. Motivational strategies for teachers

- A. Motivating by maintaining success expectations
  1. Program for success in selecting content, tasks
  2. Teach goal setting, performance appraisal, and self-reinforcement skills
  3. Help students to recognize effort-outcome linkages (using modeling, socialization, and feedback; portraying effort as investment rather than risk; portraying skill development as incremental and domain-specific; and focusing on mastery rather than normative comparisons)
  4. Include remedial socialization for discouraged students

- B. Motivating by offering extrinsic incentives
  1. Offer rewards for good (or improved) performance
  2. Call attention to the instrumental value of academic activities
  3. Structure appropriate competition

- C. Motivating by selecting or designing activities so as to capitalize on students' existing intinsic motivation
  1. Adapt tasks to students' interests
  2. Include novelty/variety elements
  3. Allow opportunities to make choices or autonomous decisions
  4. Provide opportunities for active response
  5. Include activities that provide immediate feedback to responses
  5. Allow students to create finished products
  7. Include fantasy or simulation elements
  8. Incorporate game-like features
  9. Include higher level objectives and divergent questions
  10. Provide opportunities to interact with peers

D. Motivating by stimulating students' motivation to learn
  1. General strategies
    a. Model interest in learning, motivation to learn
    b. Communicate desirable expectations
    c. Minimize students' performance anxiety during learning activities

  2. Strategies for use during particular activities
    a. Project intensity (connoting importance of activity)
    b. Project enthusiasm (for content or task responses)
    c. Induce interest or appreciation for the activity
    d. Induce curiosity or suspense
    e. Make abstract content more personal, concrete, or familiar
    f. Induce dissonance or cognitive conflict
    g. Induce students to generate their own motivation to learn
    h. State learning objectives and provide advance organizers
    i Provide informative feedback
    j. Model task-related thinking and problem solving
    k. Induce metacognitive awareness of learning efforts (actively preparing to learn, committing material to memory, encoding or elaborating on the information presented, organizing and structuring the content, monitoring comprehension, and maintaining appropriate affect)

SOCIALIZATION OUTCOMES

It is a common perception that students receive less guidance from home, church, and community than they did in the past. Teachers, therefore, are increasingly required to play a role in fostering personal and social responsibility in students. For example, the Gallup Poll continues to show that parents and other citizens place major importance on the development and maintenance of discipline in the schools. The Socialization Outcomes Project studied some of the ways that teachers can contribute to responsible student behavior through development of more positive self-perceptions.

In this project, researchers focused on how teachers help students (a) develop individual work habits and assume personal responsibility for their academic performance and (b) learn to function as constructive members of a group and thus develop social responsibility. The researchers found that teachers differ greatly in the relative time and emphasis they give to each of these two broad socialization goals while also pursuing academic goals. The study documented the teaching and learning that occur in classrooms where teachers have very different goal orientations and where students exhibited different patterns of growth on important self-perceptions. The results aid in understanding how teachers foster personal and social responsibility in students and how these socialization outcomes influence academic achievement.

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Jacqueline Nickerson
Ariel Anderson
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Donna Bird
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SOCIALIZATION OUTCOMES

Students learn more than academic content in schools. They also learn how to meet the dual demands of the student role: accomplishing individual academic tasks while simultaneously serving as a member of a social group, where each individual can affect the well-being of other students (i.e., meeting task and interpersonal demands of schooling). Socialization in classrooms is the process through which students learn the attitudes and skills necessary to fulfill the student role successfully. Among other things, outcomes of the socialization process include students' beliefs about themselves, their peers, and the work they do in school.

In addition to providing content instruction, teachers play critical roles as socializers, influencing underlying beliefs about self, others, and schoolwork. There are many questions about how teachers can best fulfill the socializing role, and the Socialization Outcomes Project addressed some of these: To what extent do teachers view themselves as socializers in addition to or instead of content instructors, and what are the implications of their priorities for life in their classrooms? How do teachers influence their students' attitudes about self, others, and schoolwork while engaged in content instruction? Are there trade-offs inherent between content learning and other, more affective outcomes, or is it possible to promote optimal growth in a number of areas?

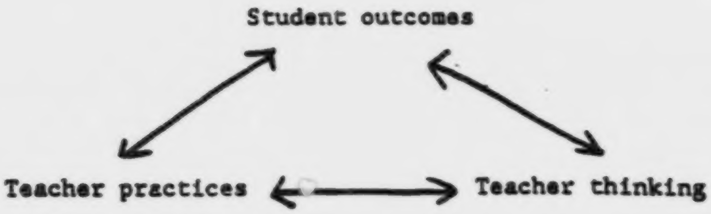
Not surprisingly, there are no simple answers to these questions in either the data of this project or in other literature.

However, the work of the project has yielded significant insights into the socialization process as it unfolds in a variety of third- and fourth-grade classrooms. For example, consider the following sampling of results. (a) Students' perceptions of themselves as task performers, especially beliefs about who controls success and failure, appear to be important outcomes that support and influence academic performance. (b) Teachers do make a difference--their socialization styles were related to student growth on desirable self-perceptions concerning task performance. (c) Teachers who had the strongest impact on their students' self-perceptions did not spend a great deal of time focusing on purely affective goals, but instead created a work environment that fostered students' beliefs about themselves as capable agents. (d) Despite many teachers' expressed priorities for promotion of students' interpersonal development, there have so far been few indicators of straightforward teacher effects on students' social attitudes, at least within the sample studied. (e) The role of teacher priorities concerning socialization is much less straightforward than was originally thought.

Throughout many of the findings runs a theme about information and control and their roles in classrooms. One way to summarize the results of the project is that good teachers carefully balance teacher control and student autonomy; they empower students by helping them develop self-control. The key mechanism through which effective socializers exert control and then transfer it to students is information--about the environment and how it will operate, and about the students, their capabilities, and their responsibilities.

The "effective teachers" identified through this study held many different priorities--some expressed strong concern for learning of academic content, others emphasized the development of work skills, whereas others placed high value on interpersonal growth. More important than expressed priorities was the manner in which teachers communicated with students concerning life in their particular classroom. The more effective socializers attended closely to students' informational needs and then provided information that helped students build coherent and complex cognitive schemes about how the classroom functioned. These same teachers also provided students with many opportunities to be independent and make choices about their activities, although always within a carefully structured framework. These teachers created classrooms that were viewed as more comfortable in affective tone, more productive of meaningful work, and exhibiting greater student self-regulation.

These results are discussed in more detail in this final report, organized according to the model of classroom socialization used in the project, depicting interrelationships among three key components:



From the beginning of the project, it was assumed that teacher thinking and beliefs about socialization of students would relate to classroom practice and that practice and thinking together would affect and be affected by the students' attitudes about themselves, others, and schoolwork. Therefore, several ways of examining teacher thinking, practice, and student outcomes were undertaken over three years of data collection.

Methods

The project involved three years of data collection with many subsamples for different measures. In brief, the first year involved administration of a questionnaire to all third- and fourth-grade teachers in a midwestern urban school district in order to tap teacher thinking about socialization of students. On the basis of this questionnaire, 32 teachers were selected for further intensive study because they differed in their expressed priorities (oriented either to task demands, to interpersonal skills, to content instruction, or to a combination of task and interpersonal concerns). Over the next two years, these 32 teachers and their students participated in a variety of data collection activities.

Twenty-four of these teachers were observed frequently over a year, yielding detailed narrative data on teachers' socialization practices, including any references to norms, standards, rationales and consequences, strategies, and affect, as well as general descriptions of teacher and student activities.

Student outcomes were measured with a series of self-perception questionnaires in the fall and spring, in order to tap beliefs that underlie development in two domains: meeting *task* demands as an individual worker and participating as a member of a *social* group, where interpersonal issues arise. These measures were as follows:

a. "Why things happen" (Connell, 1985), a measure of perceptions of control over outcomes in academic and social domains. Students indicated degree of agreement with items that described the cause of school successes and failures. This measure yielded three subscores shown to be related to student achievement and achievement motivation: unknown control (belief that one does not know what causes success or failure, which relates negatively to school success), internal control (belief that one is personally responsible, relating positively to school success), and powerful others control (belief that others, especially the teacher, are most responsible for outcomes, relating negatively to success). Both task performance and social acceptance were outcomes addressed in this questionnaire, yielding two sets of scores for each subscale.

b. "What I am like" (Harter, 1982), a measure of perceived competence in academic and social domains. Students indicated which of two types of students they were most like and then indicated the degree of similarity within the selected type. (e.g., "Some students never have any trouble getting their work done on time, but other students often have trouble finishing their work.") Again, different items addressed task performance outcomes and social acceptance.

c. "In the classroom" (Harter, 1981), a measure of preference for situations involving intrinsic versus extrinsic motivation. Within this instrument, two subscales were used: independent mastery (preference for self-selection of classroom activities, even if challenging) and independent criteria (beliefs that one can adequately judge the quality of one's own performance).

d. Sociometric rating instrument (Singleton & Asher, 1979), on which children privately rated their peers as desirable workmates and playmates.

Results: Student Outcomes

Each of these measures was selected because of a belief that academic success is grounded in personal beliefs about one's ability and control; that is, children who scored higher on the more desirable scales would be more likely to benefit from their classroom experiences, because they would believe that their efforts would lead to payoff, that they were capable of doing well, and that school tasks are intrinsically worthwhile. These predictions were grounded in much past research and a clear theoretical orientation that assumed that relationships between teacher behaviors and student outcomes of self-regulation and responsibility are mediated by students' understanding (Anderson & Prawat, 1983). Other research (Harter & Connell, 1984) has revealed the important role played by these indicators of student understanding, but it was necessary to confirm that similar patterns existed with the present sample. Therefore, a series of analyses was undertaken to determine the relationships between the different student outcome measures to try to replicate the earlier findings.

Harter and Connell (1984) used a causal modeling approach to test various models of cognitive competence with elementary and junior high samples. The model that best fit their data was one indicating that student "knowledgeability", at least in the cognitive domain, is the most critical variable in an important network of variables. According to Harter and Connell (1984), the more knowledgeable children are regarding the whys and wherefores of academic performance, the better they perform. Knowledge of the source of academic outcomes appears to set in motion a chain of events: The child performs better, feels more competent, and is more likely to be intrinsically motivated. An attempt was made to validate the Harter-Connell model using posttest data gathered during the second year. Results of this analysis are presented in Figure 1.

As Figure 1 reveals, the model obtained for the overall sample was quite consistent with the cognitive-attributional model proposed by Harter and Connell (1984). Thus, the child's level of knowledge regarding academic outcomes appears to directly influence academic achievement. Those who are more in the know (i.e., who score lower on the cognitive unknown scale) perform better in school and are more willing to accept responsibility for their academic successes than those who claim not to understand what is happening.

Following this test of the Harter-Connell model, which has relevance for the so-called "task demands" dimension of socialization, an attempt was made to determine if the cognitive-attributional process generalizes to important outcomes in the social or interpersonal domain. Figure 2 shows results of the path analysis that involved a parallel set of social measures. In this analysis, sociometric popularity was used as an outcome measure analogous to standardized achievement scores in the cognitive domain. As Figure 2 reveals, knowledgeability in the social domain directly affects popularity and internality (i.e., internal locus of control) in a way which is comparable to what was found in the cognitive domain.

Thus, the Harter-Connell model generalizes across task and interpersonal domains, and this supports the validity of the instruments as indicators of important aspects of student understanding that underlie success in school. Of course, these data do not

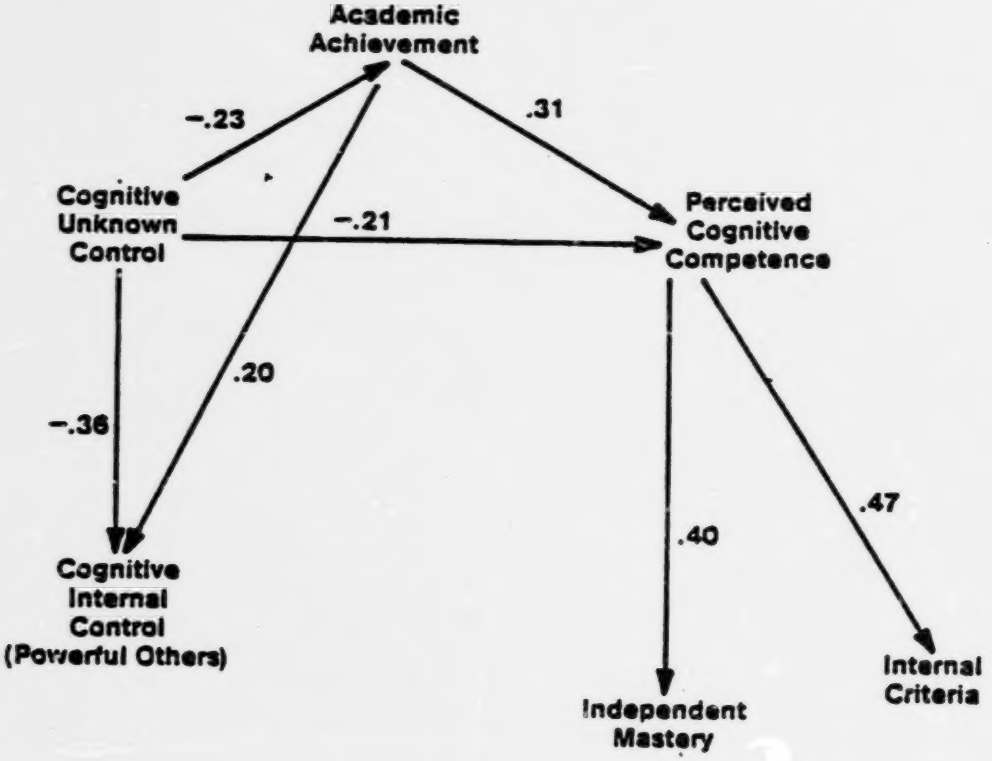

Academic Achievement
-.23
.31
Cognitive Unknown Control
-.21
Perceived Cognitive Competence
.20
-.36
.47
.40
Cognitive Internal Control (Powerful Others)
Independent Mastery
Internal Criteria

Figure 1. Path analysis of cognitive-attributional variables in the academic domain.

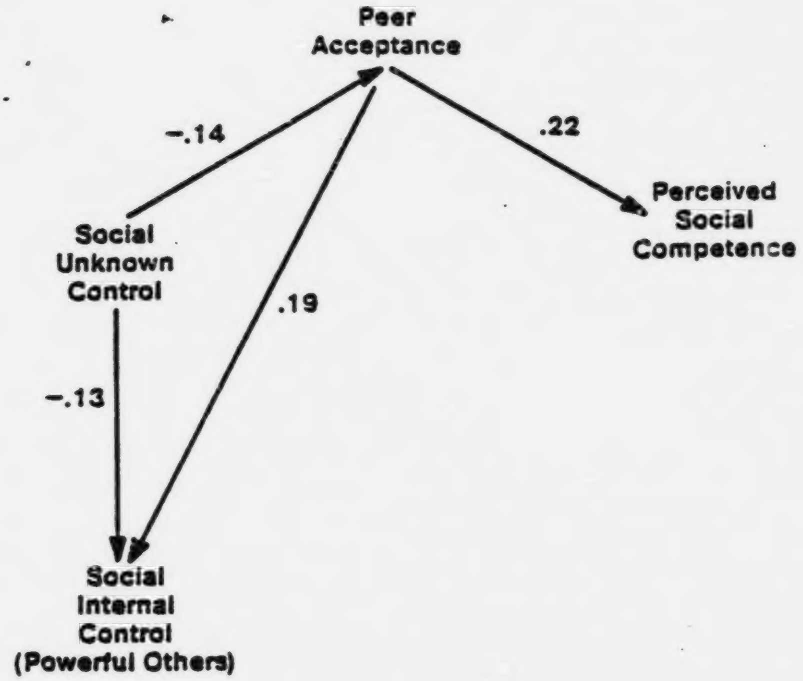

Peer Acceptance
-.14
.22
Perceived Social Competence
Social Unknown Control
.19
-.13
Social Internal Control (Powerful Others)

Figure 2. Path analysis of cognitive-attributional variables in the social domain.

confirm that these perceptions are necessarily the result of adults' attempts to socialize children, only that the measures reflect important psychological processes. Therefore, the next step in the project was to examine teacher and classroom data, and try to relate them to differences in students' reported beliefs about themselves, others, and schoolwork. Those results are given in the next two sections on teacher thinking and teacher practices.

Teacher Thinking

The aspect of teacher thinking that was selected for focus in this study was teacher priorities and goals: Did it make any difference whether a teacher valued one socialization goal over another (e.g., helping children meet individual task demands versus helping children learn interpersonal skills and tolerant attitudes toward others) or whether a teacher valued either of these over content instruction? In order to answer these questions, an instrument was developed: the Teacher Priorities Questionnaire (TPQ), described in Prawat, Anderson, Anderson, Jenkins, and Anderson (1983).

The TPQ measures teachers' agreement with three different orientations: content, task demands, and interpersonal priorities. It consists of 22 forced-choice items plus 8 distractors, each with three foils. The foils represent different priority emphases. Thus, teacher scores on each scale range between 0 and 22. A score of 14 or higher on any given scale is thought to reflect a strong goal orientation. Using this criterion, the 108 teachers in the original sample were distributed in the following way: Almost a third (31%) placed a high priority on interpersonal outcomes; a third were "mixed" in their goal orientations, with the content-task demands combination predominating over other possibilities; the remaining teachers were evenly divided between the content and task demands categories. These results indicate much variety in teachers' personal goals and priorities for their students, even though all respondents taught in the same school system and were in the same age range.

At the time they responded to the questionnaire, teachers also completed a survey that assessed adults' orientations toward control versus autonomy when responding to children (Deci, Schwartz, Sheinman, & Ryan, 1981). Scores on the Deci measure can range from a low of -18 (highly controlling) to a high of +18 (high in autonomy-granting). A mean of 5.40 was obtained for the select sample of 32 teachers; this suggests a slight preference for a more autonomy-granting as opposed to controlling style of interaction on their part.

Relation of Teacher Goal and Control Orientations to Student Outcomes

Do teacher goal orientations make a difference in terms of student socialization outcomes? The answer appears to be "not much." In order to examine this relationship, the scores on the priorities measure and the Deci control/autonomy measure were combined to create four groups of teachers: those who are (a) content-oriented on the TPQ and high control on the Deci, (b) content-oriented on the TPQ and low control on the Deci, (c) interpersonally oriented on the TPQ and high control on the Deci, and (d) interpersonally oriented on the TPQ and low control on the Deci.

Analyses of covariance, where pretest scores on each measure served as the covariate, were used to examine the relationship between posttest student scores and teacher goal and control status. Interestingly, although very few TPQ or Deci main effects were observed, the TPQ-Deci interaction proved significant or marginally significant in a number of analyses. A comparison of relevant cells reveals the nature of this interaction: Students in the classrooms of teachers who embrace what might be considered ideologically inconsistent" beliefs (i.e., interpersonal/high control and content/low control) register less growth, particularly in the task demands domain, than do those who are in the classrooms of teachers with more coherent educational beliefs.

This finding supports previous work by Halperin (1976). Halperin obtained a similar interaction between teacher goal and control orientations in a study in which student scores on attitude measures were the dependent variable. Students in classrooms of teachers who held seemingly incongruent beliefs (i.e., social-strict and academic-permissive teachers) were more anxious and less positive toward school than those in the other types of classrooms. Halperin speculates that these teachers may have produced environments that appeared inconsistent or ambiguous to children.

The results presented above indicate that teacher goal and control orientations relate in complex ways--if at all--to student outcomes measures. However, the student interviews conducted in this study suggested that teacher priorities may influence the type of information that teachers present to students, even if hearing the information does not directly affect outcomes- namely, student self-perceptions (A. Anderson, 1985). Individual students in 16 classrooms were interviewed about the social system of their classroom. One question asked them to describe characteristics of model students in the two socialization domains: "good workers" and "children who get along well with others".

Qualitative analyses of students' answers revealed some interesting differences related to teacher priority groups. For example, students in all groups of classrooms enumerated a variety of social behaviors as relevant characteristics when asked to discuss classmates they considered to be "good workers", but the greatest number of responses of this sort were given by children in the interpersonal teacher priority group. Children in classrooms of content-oriented teachers provided the fewest number of responses of this sort. Based on these and other data, it does seem evident that at least part of the teacher's priority "message" is getting through.

Even so, the teacher priority data did not reveal that teachers' goals, in the absence of information about supporting practice, are predictors of important perceptions in students. The analyses of "ideological consistency" suggest that the content of the teacher's message is less important than the consistency and completeness of the information available. This interpretation is also supported by the analyses of the teacher practice data, reported in the next section.

Teacher Socialization Practices

The primary measure of teacher socialization practices was a set of 16 half-day narratives taken over the course of one academic year in each classroom. Observers were trained to note all details concerning teachers' communication with students about standards in the classoom, how to meet them, any attributional information, and any other information that allowed readers to understand the flow of activities in the classroom. Details about academic content and tasks were not recorded, although subject matter and general descriptions of grouping and types of tasks were available.

A key hypothesis examined in analysis of the classroom narratives was that differences in teacher effectiveness in the socialization domain can be accounted for, in large part, by differences in the quality of the information provided students. Specifically, it is hypothesized that teachers who are more effective socializers provide students with the informational "tools" that allow them to regulate their personal and social behavior in the classroom. This hypothesis is consistent with research on parent socialization practices. Damon (1983) uses the term "information internalization" to describe a particularly effective child-rearing technique that relies heavily on explanation and reasoning to elicit compliance. Parents who use this technique structure the informational environment in such a way as to ensure that children understand exactly what is expected of them, why it is important, and what the consequences will be for noncompliance. Use of an information internalization strategy may be evident in teacher verbal communication with students and may account for a significant amount of the variance on student outcome measures in the task demands and interpersonal areas of socialization. This issue is addressed in this section.

Two approaches to the narrative data were taken and are described separately. The first was to describe each separate teacher statement by means of an elaborate coding system and then to determine overall patterns in the teachers' statements (described in "Teachers' Socializing Messages," below). The second method was more global and qualitative and examined broader dimensions of teacher practice, including but not limited to some of the concepts included in the coding system (described in "Dimensions of Teaching Effectiveness," below).

Teacher Socializing Messages (quantitative analyses)

For these analyses, 8 to 10 of the narratives were used, those that had focused on the teacher rather than the students. These narratives yielded from 500 to 700 socializing messages per teacher.

These statements were then coded using a project-developed coding system designed to describe several components of socializing messages. A message was considered codable if it met one of the following criteria: (a) The teacher statement or action informed students about a standard for behavior, thought, or affect in that classroom (to be a standard, the information had to be conveyed, either explicitly or implicitly, about what is appropriate and what is inappropriate and the standard had to have some enduring quality so that it could be applied to situations across time);

or (b) The statement included instances of teacher modeling clearly positive or clearly negative interpersonal regard. For each statement, information was noted about the target audience, the domain, timing, classroom context, rationales, attributions, and consequences. For a fuller description of the coding categories, see Prawat, Bird, and Anderson (1986).

All observations were coded individually by two different people. Agreement for the coding of the teacher observations ranged from 67% to 89%, with the average agreement being 77%. After data were individually coded, coders met to resolve coding disagreements so that all final scores represented 100% coder agreement. Thirty-three proportional variables were created from the coded data to describe important informational aspects of the verbal messages teachers send to children.

Results: Types of messages. Teacher communication in the socialization domain has been characterized as mostly reactive, negative, and procedural (Blumenfeld, Hamilton, Bossert, Wessels, & Meece, 1983). The present data are consistent with this description. The impression one derives from the data in the present study is that students know what is expected and simply need to be reminded to attend to the task at hand. Thus, over half of all the statements recorded were reminders of an academic or procedural sort. The following are examples of reminder statements in the task demands domain of socialization: "Tim, you're not paying attention"; or "You're so loud that I can't hear myself think." Over half of all socialization statements by teachers related to task activities, and two-thirds were reminders about staying on task. The next largest category of response (31%) related to procedures--general routines that presumably help maintain the smooth flow of activities in the classroom.* Again, a majority of procedural statements fell into the reminder category (e.g.,"Stay in your seats until your row is called for recess").

It is not surprising, in view of the above, that 71% of the socialization statements made by teachers were reactive in nature (i.e., in response to student behavior), with a fairly clear intent to change behavior. Most were made publicly and were aimed at groups of students as opposed to individuals. In their messages to students, teachers were more inclined to use "behavior modification" strategies rather than more inductive, reason-oriented approaches. Thus, in 18% of the socialization messages, teachers were either critical or punishing in reponse to some student misdeed. For the most part, these either were criticisms or involved the withholding of some privilege such as recess or freetime.

Information internalization may constitute an effective socialization strategy according to the parenting literature, but there is not a lot of evidence that teachers employ this strategy in most of their verbal interactions with students. Teachers, for example, do not do much causal reasoning with students. Only 4% of the statements made by teachers contained attributional information of any sort--either explicit or implicit.

In two other important categories, however, there was more evidence of information provision beyond reminders. The first category relates to the explicit presentation of rules, procedures, or norms. Included under this rubric are the formal rules or procedures that students are expected to follow, as well as the informal expectations or norms communicated by teachers (i.e., "I expect . . . "). Statements of this sort are made infrequently to begin with (11% of the time), but the issue is how often teachers provide rationales for these standards that go beyond simply saying "Do it because I said so." The data indicate that teachers provide nonauthoritarian rationales for their rules 10% of the time. Approximately the same proportion of teacher communication (11%) in the socialization domain is "instructional" in nature. This last variable is a rather straightforward one: It represents the proportion of total statements that provide explicit instruction about how to meet a particular rule or standard for behavior. The numerator for this proportion was derived by summing the total statements that included either verbal or "nonverbal" (i.e., demonstration) instructional information relating to a standard. An example of the latter would be a teacher walking students through a procedure.

Overall, it appears that most teacher statements are not very explicit, either about what students are supposed to do or how they are supposed to go about doing it. This is not necessarily unreasonable, considering the rapid pace and routine nature of most classroom life. The next issue to be addressed relates to the effect, if any, of differences in the informational content of teacher mesages on student attitudes or beliefs in the task demands and interpersonal socialization domains.

Results: Relationship with student outcomes. Here, consideration is given to the relationship between informational variables and student growth in the task demands and interpersonal domains of socialization. To examine teacher effects, scores were created to describe the extent to which students' scores in a classroom on the perception measures reflected desirable change (i.e., greater-than-predicted growth on a set of measures in the task demands area and in the social area). These procedures are described in Prawat (1985).

The question addressed by the analyses was a straightforward one: Do differences in the type of information teachers present to students correlate with changes in student self-perceptions on these two variables? Some interesting relationships between categories of teacher talk and residual scores on the two socialization factors did emerge. Most of the significant correlations, moreover, seem to be consistent with an informational hypothesis. Because results in the task demands domain are more interesting, they will be highlighted here. Suffice it to say that student growth in the interpersonal domain correlated most highly with the amount of emphasis given that domain in teacher verbal communication. Thus, the amount of public feedback and the proportion of teacher messages dealing either with interpersonal concerns or social consequences of student behavior all correlated with residual gain on the social factor.

Not surprisingly, residual growth on the variables thought most relevant to the task demands dimension correlated most highly (.57) with teacher use of explanation and reasoning. The proportional score that perhaps best captures this propensity to reason was described earlier: It represents the extent to which teachers provide students with rationales for classroom rules or standards. Several types of nonauthoritarian rationales were identified during coding; teachers who had higher scores for the overall category used more of these in their communication with students (Bird, Anderson, & Prawat, 1985). Overall, the most widely used type of rationale, accounting for 56% of the total, was one in which teachers justified a norm or standard in terms of the likely effect noncompliance would have on other students or on the teacher (i.e., " . . . because I can't think when you're so loud"). The apparent importance of rationales of this sort in the development of student self-regulation is not surprising in light of research on parent socialization practices. The work of Hoffman (1975) and Zahn-Waxler, Radke-Yarrow, and King (1979) supports the important of "other-oriented" reasoning in parent-child communication.

With correlational data of this sort, of course, it is impossible to determine if teachers are more positive and informational in their communications with students because the students are more self-regulated or if student behavior caused the teacher to give different types of messages. However, the qualitative data analyses reported in the next section lend support to the interpretation that the teachers were indeed most responsible for the type of information conveyed to students and that differences in student outcomes are at least partially attributable to the teachers' practice.

Dimensions of Teaching Effectiveness (qualitative analyses)

One of the major questions addressed in this study was, Do classroom processes and teachers' practices influence changes in students' task and social perceptions? The previous section addressed this question for one quantifiable aspect of teachers' practice: discrete categories of verbal statements. In this section, more general, qualitative dimensions of teacher practice are examined. The ultimate goals were to identify teacher practices that were associated with desirable changes in students' perceptions, and to explain how such effects occurred. In order to reach these goals, two types of analyses were performed.

First, it was necessary to confirm that there were indeed classroom-level differences in students' perceptions that were attributable to factors other than preexisting student differences. In particular it was necessary to determine the extent to which grade level and socioeconomic status (SES) were associated with the perceptions of interest and whether classroom process measures (including teachers' practices) independently accounted for a significant portion of the variance in student perceptions, then the second type of analysis was performed: qualitative examination of classrooms where there were apparently very different patterns of student perception change.

In this section, the results of the two types of analyses are summarized and used to support the argument that classroom processes and teachers' practices do influence students' perceptions, even though age and SES are also important predictive factors. Two dimensions of teacher socialization style proved to be especially important: structuring of information about the environment in order to render it understandable and predictable and provision of opportunities for students to practice self-regulation and self-control.

All analyses in this section of the report are limited to 19 classes that were either third or fourth grades, eliminating mixed-grade classes and second- and fifth-grade classes.

Statistical tests to support qualitative analyses. Before statistical analyses could proceed, a series of new variables was created. A new method of measuring change in perception scores was developed and used to address the question of whether classroom-level factors made a difference, with age and SES of student taken into account. This was accomplished by rating changes in relative standing on three sets of classroom means of perception scores: task perceptions (combining control measures, motivation scales, and perceived competence in the area of academic task performance), social perceptions (combining control measures and perceived competence in the area of social acceptance), and popularity (reflecting the extent to which students liked others in their classroom). Procedures for determining these ratings are described in forthcoming project reports. In all cases, inter-rater reliability was high and significant.

Descriptive data from each classroom were rated on three scales that defined important aspects of classroom climate that reflect and promote socialization: affective tone (the extent to which the the general emotional tone was pleasant and cooperative), task tone (the extent to which students and teacher were involved in meaningful tasks and apparently interested in learning), and self-regulation (the extent to which students were independent and self-initiating in carrying out classroom tasks and procedures). These rating scales are also described in detail in a forthcoming project report and also evidenced high inter-rater reliability.

A series of statistical analyses was performed with the six ratings to determine what factors best predicted student perceptions, as measured by the first three ratings. Of particular interest was the relative contribution of demographic variables (grade level, socioeconomic status, busing status, and the percent of each class that were members of a minority group) in comparison to the classroom climate ratings (affective tone, task tone, and self-regulation).

The first analyses performed were correlations between all ratings and demographic variables, given in Table 1. None of the demographic variables were significantly associated with each other. Socioeconomic status was measured by the school district's indicator: percent of students at each school from families receiving AFDC (so that higher scores indicate lower SES). This indicator of SES correlated negatively with both task perceptions and social perceptions. The only other demographic variable that correlated significantly with ratings was busing status, which correlated significantly with all three climate ratings, with bused classes having higher climate scores. (Analyses continue into the reasons that busing correlates with classroom climate. The result may not be due to busing per se, but to the fact that more generally effective teachers were present at bused schools. Given the small sample

Table 1. Intercorrelations of Ratings and Demographic Variables

	AFDC[a]	Percent Minority Sts.	Grade	Busing[b]	Task Perceptions	Social Perceptions	Popularity	Affective Tone	Task Tone	Self-Regulation
AFDC	1.00									
Percent Minority Sts.	.34	1.00								
Grade	- .04	.06	1.00							
Busing	- .09	- .10	.17	1.00						
Task Perceptions	- .61**	- .21	.15	- .35	1.00					
Social Perceptions	- .45*	- .27	.11	.14	.61**	1.00				
Popularity	- .23	- .00	.09	.43	.05	.23	1.00			
Affective Tone	- .38	- .12	- .25	- .54*	.55*	.14	- .03	1.00		
Task Tone	- .34	- .03	- .15	- .65**	.56**	.11	- .11	.90**	1.00	
Self-Regulation	- .32	- .08	- .06	- .54*	.64**	.09	- .11	.85**	.88**	1.00

N = 19

[a] AFDC = % sts. at school from homes receiving Aid to Families with Dependent Children

[b] 1 = Bused school, 2 = Neighborhood school

* $p < .05$

** $p < .01$

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size and uneven distribution of bused classes in the sample, no interpretation of these data is offered at this time.)

Several of the ratings were highly intercorrelated. The three climate scales were positively and significantly correlated with one another and with ratings of task perceptions, although not with social perceptions or popularity. Task perceptions and social perceptions were correlated with one another.

These findings suggested that task perceptions were related to a variety of variables, both demographic and classroom climate, while social perceptions and popularity were less easily predicted from these data. Although analyses of the social data continue, especially in the analyses of racial bias and busing influences (Nickerson, Anderson, & Stevens, 1986), the remainder of this report will focus on further analysis of the task perceptions data.

The next analysis performed was a stepwise regression, with task perceptions as the dependent variable and AFDC, busing, affective tone, task tone, and self-regulation as independent variables. The results of these regressions may be found in Table 2. These analyses revealed that task perceptions were predicted more strongly by a model containing both the self-regulation rating (which was highly correlated with both affective tone and task tone) and the AFDC percent, used as an indicator of socioeconomic status).

These results suggest that socioeconomic status does appear to be a significant predictor of task perception ratings, with negative correlations between ratings and SES. However, classroom climate, especially the extent to which students appear to be self-regulating, also makes a significant contribution to student task

Table 2. Regression of Task Perception Ratings on AFDC and Classroom Climate Ratings

Descriptions of models:

	Predictors	Beta	*F* for predictors	*p*	*F* for model	*p*	*df*
Model 1:	Self-regulation	.64	11.86	<.01	11.86	<.01	1, 17
Model 2:	Self-regulation +	.49	8.61	<.01	11.69	<.01	2, 16
	AFDC	-.45	7.19	<.01			
Model 3:	Self-regulation +	.62	6.01	<.05	7.50	<.01	3, 15
	AFDC+	-.47	7.07	<.01			
	Affect	-.15	.24	ns			

Model 4: *F*-test criterion exceeded when task rating added; model not completed.

Comparisons of models:

	R^2	Adj.R^2	Standard Error	*F*	*p*
Model 1 vs. Model 2					
Model 2	.59	.54	.87	5.2	<.05
Model 1	.41	.38	1.01	*df*=1, 15	
Model 2 vs. Model 3					
Model 3	.60	.52	.89	.35	ns
Model 2	.59	.54	.87	*df*=1, 14	

perceptions. These findings support the move to qualitative analysis of the narrative data, where the teacher's role in establishing classroom climate may be examined in more detail. However, these results also suggest that caution is necessary in comparing classrooms that differ in students' socioeconomic status.

Qualitative analyses of narrative. A full report of the qualitative analyses is impossible in this space, and some qualitative results are presented in other papers (L. Anderson, 1985; Appelman, Anderson & Prawat, 1986; Bird, Anderson, & Prawat, 1986). A series of contrasting case studies (with teachers paired for SES of school) is in progress and will serve as both data presentation and case material for use by teachers and teacher candidates. In these contrasting cases, two dimensions of socialization are defined and illustrated: structuring of information that renders the environment predictable and comprehensible to students and providing opportunities to practice self-regulation. These two dimensions help explain how and why students' task perceptions are influenced by the ways in which teachers set up task systems and opportunities in the classroom.

Structuring of information to render the environment predictable and comprehensible. Sociolinguistic research in classrooms (e.g., Cazden, 1985; Green & Smith, 1983) has highlighted the important role of rule-governed communication and the ways that classroom interactions can break down when students have failed to draw the expected inferences about appropriate responses in particular contexts. In this study, one of the most important features of "more desirable" classrooms (where students' perceptions of themselves as task performers improved or was maintained at a high level) was the teacher's role in reducing the inference burden on students. Teachers in the "more desirable" classrooms deliberately and explicitly presented information that would aid the child in constructing a scheme about the classroom that matched the teacher's desired scheme.

Teacher structuring included provision of procedural details but was by no means limited to this domain. Teachers in "more desirable" classrooms also provided much information about the contexts within which activities occurred. For example, teachers pointed out occasions of environmental regularity ("We will always have silent reading after lunch this year") as well as reasons for exceptions that rendered them logical to students ("Today will be different because we have to be in the gym at 10:00 for pictures"). Consistency in following through on their predictions was also apparent.

Teachers also structured information by explicitly linking ideas: relating examples of specific rules to broader principles, relating an incident today to a similar incident last week and discussing the underlying commonality, and relating rules and rationales or consequences.

Teacher structuring has also been described in the classroom management literature that emphasizes the importance of communication about rules and procedures at the beginning of the school year (Evertson, Emmer, Clements, Sanford, & Worsham, 1984; Anderson, Evertson, & Emmer, 1980). The results of the present study go beyond the earlier management research in two respects. First, Evertson, & Emmer, 1980). The results of the present study go beyond the earlier management research in two respects. First, differences in teacher structuring behavior are related to data on students' perceptions, and hypotheses are developed about the cognitive-mediational links that would account for those relationships. Second, these data also focus on a second dimension of socialization, without which the cognitive schemes formed by the child would not be useful: the opportunities available to the child to use knowledge about the environment to regulate independent activity.

Provision of opportunities to practice self-regulation within a predictable environment. Teachers in "more desirable" classrooms created opportunities for students to monitor themselves during task performance while still holding them accountable for task completion. This was done by allowing some choices within limits, not by abdicating all monitoring responsibility to students.

Sometimes, such opportunities were built into regular routines for work accountability. The result (at least by midyear) was that the teacher was not the sole decision maker about what would be done at what time, in what order, and in what manner.

Relating the two dimensions to development of students' task perceptions: An emerging theory. Earlier work by Harter and Connell (1984) suggested that a key determinant of the self-perception measures used in this study is students' knowledge of what controls outcomes, which implies a belief that events are predictable and can be attributed to consistent causes. Work within this project has attempted to link these earlier findings of Harter and lead first to greater student knowledge of control, then to other desirable self-perceptions.

Weisz and Stipek (1982) suggested that the development of effective self-perceptions might depend on first recognizing contingencies within the environment and then recognizing that one is personally competent enough to set contingencies into motion. The explanation for the present results is similar. Before students can perceive a consistent source of control, they must perceive predictability in the environment; that is, the student must accept that the classroom environment is rational and that the student has the necessary knowledge to explain events. This means that events have meaning, in that they are part of a consistent network of cause-effect, sequential, or hierarchical relationships. By structuring information about the environment that allows students to see these predictable relationships, teachers can contribute to students' knowledge of control.

Once knowledge of control is established, then teachers also facilitate development of other self-perceptions through communication of positive expectations for independence and opportunities to practice self-regulation. Once students know that task performance outcomes have reasonable explanations, then they can learn that they themselves are important causal influences (i.e., they begin to develop an internal locus of control). When practice in self-regulation is successful and students see that they are indeed the cause of that successful performance, then self-perceived competence may also increase. In these circumstances, the student and teacher are more likely to share a common understanding of the rules of social intercourse, preventing the breakdowns that occur when implicit rules of communication are not shared, as is described in much of the sociolinguistic studies of classrooms.

This emerging theory cannot be tested directly, because student perception changes could not be closely tracked over the school year. However, the theory is offered as speculation about one way to tie together the qualitative classroom data, the associated changes in student perception measures, cognitive developmental theory, and sociolinguistic views of the role of shared norms.

Conclusions

In this study, a small but important set of outcomes was studied: students' perceptions about themselves as task performers and as members of a classroom group. It has long been known that such self-perceptions vary as a function of patterns of parenting (Maccoby & Martin, 1983). In spite of the strong influence of parenting and other out-of-school influences, many educators share the belief that a teacher can also influence the way that children feel about themselves. Indeed, the first results of this project--the teacher questionnaire data--revealed that teachers as a group did value the socializing aspect of their role.

Although the data of this study do not suggest that teachers' influences are stronger than family background, the results do provide strong evidence that the way that a teacher creates and communicates about the life of a particular classroom can make a tremendous difference in children's beliefs about themselves.

Teachers' tasks are seemingly endless; parents, principals, and students all expect teachers to do many things besides content instruction. The data from this study reveal that, with all of the limitations of too little time with too many students and too many demands, many teachers are succeeding in affecting their students' personal and social development while still focusing the business of the school day upon content teaching and learning.

Although the narrative data revealed some classrooms that were not ideal environments for students, the most notable results of the study are the descriptions of the several classrooms where children were visibly learning to be responsible and to feel good about it. For this, they and their parents can thank the teacher.

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CONCEPTUAL ANALYTIC

As a complement to its empirical work, the IRT has initiated this project to evaluate ideas and practices recommended to teachers and teacher educators. Too often, practices and policies have been advocated and adopted on the basis of commonsense or theoretical assumptions without sufficient critical or empirical evaluation. The project stresses conceptual analysis--clarifying important differences between seemingly similar ideas, assessing the adequacy and completeness of the rationales underlying recommended practices or conceptions, and identifying hidden assumptions or unrecognized complications that restrict practical application, or make it questionable altogether. Project work also considers how words and modes of communication are and should be used in order to get teachers and teacher educators to believe or do certain things. These analyses are informed by reviews of empirical and other scholarly literature in education, social science, and philosophy. Where appropriate, project analyses include arguments for alternative ideas, approaches, or practices.

Researchers have identified important weaknesses and limitations in the popular belief that what teachers learn in the field is more useful and valuable than formal course work. In general, they have argued that strong reliance on (firsthand) experience as a principle of curriculum and instruction works against equality of educational opportunity. They have analyzed the contributions of different kinds of knowledge to teacher education and teaching, showing how research knowledge differs from both personal belief and practical wisdom, and have discussed problems and conditions of research utilization and communication. They have considered aspects of the normative structure of teaching role, such as reasonableness and open-mindedness.

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CONCEPTUAL ANALYTIC

In what follows, we present, first, our findings on knowledge utilization and the teaching role in a series of elaborated theses. Then we will summarize our work on (firsthand) experience in teaching and learning. The remainder of the report will cover work completed since April 1986.

Knowledge Utilization and the Teaching Role

The notion that research findings should be used to improve teaching seems straightforward. Yet this notion, captured in the concept of knowledge utilization, is surrounded by irrational assumptions that include (a) a belief that, in using research knowledge, practitioners will come to act wisely, (b) a belief that research knowledge must be useful, or directly applicable, to be of value, and (c) a supposition that defining "the useful" in teacher education and teaching is not problematic. In clarifying and criticizing these hidden assumptions, we have argued that

> 1. Knowledge use and wise action are not the same; good teaching cannot be accounted for in terms of knowledge and the pursuit of utility only. Instead, wise action presupposes attending to the largest number of pertinent concerns, which are often competing. Concerns relevant to teacher actions and decisions can stem from habit and reflection, facts and ideals, norms and commitments, and many things besides. Reliance on knowledge and utility rules out as irrational commendable action driven by ideals and conviction. Still, sticking to what is mere opinion, false or irrelevant, will not make action more wise. Although problems in the practicing professions do not always derive from lacks of knowledge or competence, good practice does require knowing what is true or false, avoiding and correcting error.
>
> 2. While debates about whether research knowledge is useful typically center on whether certain lines of inquiry or

findings supply effective means to given ends, they should be recast as entries into deliberations about reasonable specification of practical ends (and means), and of their proper mix or sequence where they are competing. This deliberative search avoids equating the value of research with some simple and direct utility ("applicability"), pays attention to concrete circumstances (particular situations, people, purposes, capacities), and broadens the scope of concerns seen as pertinent to improving teacher education and teaching. Being more appropriate to the nature of educational research and practice, this approach to the theory-practice problem is less likely to mislead either enterprise. (See #11 & #12 below.)

3. Unexamined and affectively charged beliefs in the utility of research knowledge can crowd out other aspects of the value of inquiry, as well as other valid bases for action. These beliefs also encourage overestimating the soundness, generalizability, and applicability of educational research findings, which are time-bound, theory-dependent, and selective. In short, the tentativeness of knowledge is a safety catch that a pretension to usefulness tends to remove. At worst, the push for utilizing research findings may encourage borrowing the authority of science for interested purposes, reduce the open-mindedness of educators, and interfere with the central scientific pursuits of reiterated knowledge testing and of creating new problems and ways of knowing.

4. Identifying personal or customary ways of teacher thinking and acting with practical wisdom is also misleading, for both are affected by elements of arbitrariness that stem from three sources: lacks and imperfections of knowledge (e.g., indeterminacy of research knowledge, ambiguousness of experience, unpredictability of the outcomes of action), tensions and complications in the moral framework of teaching (e.g., dilemmas and multiple obligations), and the personal nature of practice with its roots in the quality of wanting. Practical decisions are tentative acts of willing, inchoate and uncertain in a way the imperfect knowledge of science is not. Precisely because teaching practice is personal, often requires suspending some obligations in favor of others, and routinely overestimates the determinacy and applicability of available knowledge (whatever its source), being prepared--willing and able--to stand back on occasion from given ways of thinking and acting is a defining characteristic of practical wisdom.

5. Conversely, reliance on the given and personal habits and beliefs can block the flow of speculation, conversation, and reflection by which teachers appraise and revise habits of action and mind. Among the givens not to be set aside,

however, are the justified expectations of others (students, parents, administrators, the public at large) defining the teaching role in a moral and sociological sense. To be reasonable, teacher thinking must therefore reach beyond the particulars of teachers' own actions and inclinations to consider role obligations and larger, organized contexts relevant to the teaching role such as the disciplines of knowledge, laws, and societal issues. Teachers must submit to impersonal judgment and be open to change for good reasons, for what they do is neither private nor sacred but subject to judgments of worth and relevance. In other words, being reasonable and open-minded are requirements of the teaching role.

6. Educational research can contribute to reasonableness and openmindedness by exemplifying the ethos of inquiry and by providing facts and ideas that illuminate, expand, and challenge given frames of reference. In their processes and mores, research communities are organized for the discipline of second thoughts and the quickening of new ones. Perhaps most important, the process of inquiry is a continuing demonstration of the difference between serious possibility (believing something for reasons good enough to go on) and unalterable certainty (taking something for granted as true or right, no matter what). However, as a community, educational research has a weak intellectual and casually guided normative structure. Ideology-ridden like the social sciences, it lacks crucial controls enforcing scientific norms, such as the requirement for replicability. This puts enormous burdens on individual researchers and raises serious problems of standards and guidance. (See #12 below.)

7. Conceptions and modes of knowledge use adequate to the ideals of educational research and practice can be derived from the distinction between serious possibility and incorrigible certainty. The practical and moral import of this distinction derives from teachers in the separate classrooms holding social and epistemic authority in conjunction, having the final say on what is justified belief as an underpinning for teaching decisions (process and content). Making this distinction acknowledges the practical need for certainty as an inherent feature of knowledge use, while shifting the grounds of epistemic authority away from privileged access to knowledge (personal or scientific) to processes by which lines of thought and action can be examined and revised. In brief, trust and doubt are the two faces of knowledge use. For one cannot use knowledge without putting trust into it, and its days as knowledge--justified belief--are counted where trust is complete and unquestioning. The hesitation to trust is realized in observation, reflection, discussion, and revision--"second thoughts" that, on the whole, tend to be better than first ones.

8. Presenting recommendations for action as research implications ignores the distinction between serious possibility and incorrigible certainty and masks the fact that such claims are extensions and augmentations ("amplifications") of data and ideas requiring judgment and "second thoughts." In this context of usage, implications are usually not regarded as contributions to discussion or problematical statements, but as logical consequences that appear indefeasible. Since people want to believe that what they do is the thing to do, definitely, and that it is based on solid as opposed to shifting grounds, the rhetorical force of the term "implication" appeals to the needs and hopes of audiences. By a suggestion of cogency which supplies a feeling of certainty, the persuasive rhetoric of implications reinforces the false belief that educational research can provide authoritative guidance for teaching policy and practice.

9. In general, persuasion induces belief or conformity to certain lines of action; failing to pay attention to the rationality of audiences, persuasion makes it less likely that research knowledge will be understood or used appropriately by practitioners and policymakers. A transit system of assertions (implications, findings, conclusions) may be rapid, but it fails as communication of research. If researcher claims are reasoned judgments, the reasons have to be communicated along with the judgments. Still, persuasion can be a means for helping others acquire justified beliefs--especially in offering facts and ideas that entail revising old frames of reference. Yet persuasion due to unwarranted assumptions of epistemic or moral authority is a kind of betrayal: a grave violation of trust. Once there is distrust, differences (e.g., in beliefs or backgrounds) shade into suspicion and disregard, eroding the basis for communication. Among the penalties for violating trust is the loss of opportunities for questioning and enlarging understandings.

10. By contrast, the rhetoric of explanation advances understanding and marks off (mere) persuasion from research communication. In explaining, people clear something from obscurity or difficulty, state its import or significance, show how it relates to other things already known, and give an interpretation that accounts for some object of interest, illuminating causes, origins, or reasons. Explanation is consonant with the aims of science and with the aims of action, too, insofar as action presupposes knowledge and understanding. The rhetoric of explanation is compatible with making the most of scientific knowledge, in a defensible way. The proper explanation of research also renders it discussible. Facts and ideas can then be ventilated: exposed to public notice and consideration, and a free examination from different sides. Explanation, however, cannot solve all problems of research communication. (See #12 below.)

11. Interactive modes of knowledge use appear to fit with both the imperfections of knowledge and the fact that social and individual action proceed from multiple concerns that are often conflicting. Talk among different groups in education (e.g., researchers, teachers) can be helpful since it provides opportunities for explaining and discussing beliefs and practices. While researchers tend to advocate argumentation for these purposes, arguments often substitute the goal of winning for that of understanding, and entries must conform to the argumentative mold. Conversations are less restrictive, less competitive, and more egalitarian, for they allow for breadth of subject matter and different voices. However, conversations are productive only where people know *something*, and they cannot establish (systematic) knowledge. Also, opportunities for conversation among diverse groups in education will not be broadly available. This fact limits the viability of interactive modes of knowledge use.

12. The written report thus remains a principal means for communicating educational research and related recommendations to general audiences. To do justice to itself and the audience, research writing must go beyond persuasion to lay out the backing (ideas, data, concerns) for conclusions and recommendations. But research writing misses its point if it simply passes the audience by: It has to meet conditions of access, belief, and impact. This raises difficult problems. If the audience is to come to know researcher claims as warranted, reporting has to rely on the rhetoric of explanation. Yet excessive explanation impedes communication by interfering with access and belief conditions. The limits of explanation, in turn, imply a pull toward persuasion. These problems of practice and principle have to be managed by educational researchers who are usually not self-conscious about reporting to general audiences and not selected for their talents and training in this area of work, where the structure of control exercised by qualified peers loses its power.

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Buchmann, M. (1984). The use of research knowledge in teacher education and teaching. *American Journal of Education*, *92*, 421-439.

Buchmann, M. (1985). Improving education by talking: Argument or conversation? *Teachers College Record*, *86*, 441-453.

Buchmann, M. (1985). *Role over person: Legitimacy and authenticity in teaching* (Occasional Paper No. 87). East Lansing: Michigan State University, Institute for Research on Teaching. (In press as "Role over person: Morality and authenticity in teaching," *Teachers College Record*.)

Buchmann, M. (1985). *Research conclusions in education: What they are and how they should be communicated* (Occasional Paper No. 96). East Lansing: Michigan State University, Institute for Research on Teaching. (Forthcoming, in a revised version as, "Reporting and using educational research." In J.I. Goodlad, Ed., *Ecological perspective on school improvement*, 1987 yearbook of the National Society for the Study of Education, Chicago: University of Chicago Press.)

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Experience in Teaching and Learning

We have worked on three areas related to experience: learning from firsthand experience, making breaks with everyday experience in schools, and pitfalls of experience in learning to teach. Our central arguments are summarized in the following three sections.

Education: The Overcoming of Experience

"Experience is the best teacher." In U.S. education, there is a common belief in the educative value of firsthand experience, of "being there" and "doing it" and "seeing for oneself." Teachers, for example, claim to have learned from classroom experience most of what they know about teaching. Children, too, are seen as learning best when firsthand experience is the basis for what they are taught.

We have questioned the presuppositions that favor firsthand experience. First, we have looked at what is entailed when education and firsthand experience are described as if they were equivalent. Beliefs in such an equivalence presuppose a commonsense theory of knowledge and mind that philosophers of science have found to be inadequate, a theory where tenets of knowledge are not presented as postulates at all, but are taken as given and undeniable because of their origins in sense experience. Second, we have used research on the social psychology of judgment to identify faulty inferences that frequently result from learning by firsthand experience. Ordinary judgment relies on strategies that reduce complex tasks of inference to simple operations (Nisbett & Ross, 1980). Many of these commonly used heuristics are not trustworthy and may become cognitive traps that prevent education.

Third, we have considered how firsthand experience can close avenues to conceptual and social change. For example, to learn from firsthand experience is often to confound whatever happens with necessity. Thus, in the history of vocational education, learning by doing was advocated as a means of fitting students to the real world, thereby curbing their aspirations. Finally, we have argued that ideas based on secondhand information (e.g., ideas found in books) are more likely than firsthand experience to expand the scope of thoughts and actions that can be envisioned. Education gives access to thoughts and theories that are beyond the scope of firsthand experience.

Questioning Continuity Between Schools and Everyday Life

During this century, American schools have increasingly come to be seen in a continuum of experience that spans family, community, and the world of work (Powell, Farrar, & Cohen, 1985). Secondary-school teachers are urged to make courses relevant to their students' past lives and expected careers. Elementary-school teachers are told to stress the everyday usefulness of mathematics and spelling. Many educators assume that without such links to everyday life students will not be motivated and will have difficulty learning.

Emphasizing continuity with everyday life, however, can confuse regard for students and their interests with accepting all personal beliefs and stressing the practical relevance of school knowledge. We argue that emphasizing continuity conflicts with two central goals of schooling: promoting equality of opportunity and developing disciplinary understanding. For, unless students can break with their everyday experience in thought, they cannot see the extraordinary range of options for living and thinking; and unless students give up many commonsense beliefs, they may find it impossible to learn disciplinary concepts that describe the world in reliable, often surprising ways. Everyday experience is unlikely to further these goals and often leads away from them to inequality of opportunities and the deceptions of everyday life. Schools, as places set apart, have a mandate to give students the opportunity and power to break from their extramural experiences and everyday thinking.

Cognitive researchers recognize the value of breaks, yet show ambivalence by advocating continuity; the same is true of John Dewey. Ambivalence may result from recognizing that breaks with everyday experience come at a cost: School learning means losing the sense that life is seamless and whole and the comforting assumption that things, once learned, are safe from change and challenge. Yet whatever its merits, everyday knowledge is parochial and idiosyncratic. The attractions of close ties to everyday experience and its traditions must be weighed against the benefits of breaking away from such experience for purposes of equality of opportunity and disciplinary understanding.

Pitfalls of Experience in Learning to Teach

Implicit trust in firsthand experience is particularly evident in discussions about learning to teach. When teachers look back on their formal preparation, they generally say that student teaching was the most valuable pert. In deference to this belief, teacher preparation programs give more and more time to classroom experiences, whereas inservice programs stress teachers sharing their experiences with one another. The expectation that something will be learned through classroom experiences is probably justified. Yet not all learning is productive or desirable.

Through observations and interviews of students learning to teach, we have identified three pitfalls of experience that arrest thought or mislead prospective teachers into believing that the central aspects of teaching have been mastered and understood.

The "familiarity pitfall" arises from the fact that prospective teachers are no strangers to classrooms. Students learning to teach have ideas and images of classrooms and teachers laid down through many years as pupils themselves, which provide a framework for viewing and standards for judging what they see that may remain unquestioned. Classroom experience in itself cannot be trusted to deliver lessons that shape dispositions to inquire and to be serious about pupil learning. On the contrary, it may block the flow of speculation and reflection by which we form new habits of thought and action.

The "two-worlds pitfall" arises from the fact that teacher education goes on in two distinct settings (schools and the university) and from the fallacious assumption that making connections between these two worlds is straightforward and can be left to the novice. Students need help to see how what they learn as university students can shape their thoughts and actions as teachers: how understanding can clarify and shape ways of doing.

The "cross-purposes pitfall" arises from the fact that classrooms are not set up for teaching teachers. The legitimate purposes of teachers center on their classrooms and established, successful activities, rather than on the needs of student teachers to analyze various activities and modes of teaching and learning. Overcoming the "cross-purposes pitfall" will require changes in teachers' roles to encompass teaching teachers, and structural and normative changes in schools to accommodate these role changes.

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Floden, R.E., Buchmann, M., & Schwille, J.R. (forthcoming). Breaking with everyday experience. Teachers College Record.

Feiman-Nemser, S., & Buchmann, M. (1985). Pitfalls of experience in teacher preparation. Teachers College Record, 87, 529-544.

Project Work Recently Completed

Teaching Knowledge: The Lights That Teachers Live By[1]

In all activities and walks of life, people use knowledge. Knowledge is about different things and enables different kinds of action. It also differs in how widely it is distributed, how it is gained and held, and how it is seen as warranted. When things are a matter of common sense, the question of warrants may not even arise, and even contradictions are taken in stride.

People acquire knowledge through participating in cultural patterns; such participation entitles them to being a member of groups and performing social roles. Some cultural patterns have fewer and more highly selected participants than others. These differences relate to their pervasiveness: the degree to which cultural patterns are diffused through different activities or walks of life. They affect, in turn, the degree to which associated knowledge is valued and divided among or dispersed over groups. Although people prize common sense and consider some scarce knowledge ornamental at best, the arcane tends to be valued more highly than widespread knowledge.

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[1] Buchmann, M. (in press). (Occasional Paper No. 106). East Lansing: Michigan State University, Institute for Research on Teaching.

How special is teaching knowledge? Teaching is a pervasive activity, diffused through all activities and walks of life. Cat-burglars, janitors, radiologists, and Flamenco dancers are taught how to do their jobs, mostly by people not trained as teachers. In everyday life, people show each other how to do things, explain proceedures or concepts, and respond by praising or correcting the learner in the situation. And every day, millions of children watch their teachers; in American schools, six hours a day, five days a week, for twelve years. The "apprenticeship of observation" (Lortie, 1975) gives them a close-up, extended view of what teachers do.

It follows that teaching knowledge will not be considered special and that people will be ambivalent about its value. Just as common sense and everyday experience, it will be taken for granted: valued, yet seen as a matter of course. Where teaching is concerned, who are the ignorant? If participating in cultural patterns entitles one to role performance, few seem excluded from teaching. When personal biography and everyday experience supply recipes that work, special schooling for teachers need not be arduous or lengthy, nor is it so. What has not been picked up in the school of life, will be learned by teaching.

Does the ambiguous status of teaching knowledge matter? While schoolteachers are appointed to a particular office, it is unclear whether much of what they know is special: restricted to official role incumbents and exceptional or marked off by character, quality, or degree from ordinary knowledge or common sense. People feel entitled to use their common sense in teaching. This is why the term "teaching knowledge" is more appropriate than "teacher knowledge." Using the term teacher knowledge implies that what is known is special to teachers as a group, but the term "teaching knowledge" allows considering knowledge related to the activities of teaching while leaving that question open. The emphasis on teaching knowledge is therefore no quibble; rather, it is an attempt to be descriptive and to avoid foregone conclusions relating to teacher advocacy and ascriptions (or denials) of professional status. Though a central and apparently motivating factor in recent discussions of the knowledge teachers use and hold (see, e.g., Diorio, 1982; Elbaz, 1983; Schoen, 1983), these matters are beside the point when trying to understand what lights teachers live by.

For a mass occupation dominated by women, with a flat career, comparatively low pay and status, eased entry and low retention, these ambiguities might be considered a boon, for they imply that occupational commitment--making teaching one's consistent line of work in which one sacrifices time and effort in training and stands to gain due to superior practice (Geer, 1968)--may not be necessary for acquiring teaching knowledge. In fact, these structural features of the occupation may be correlates of its cognitive basis in the folkways of teaching.

Yet most theorists consider these ambiguities evils and pit their arcane versions of teaching knowledge against the folkways. They invoke expertise where people think that common sense suffices. They look to teachers' private beliefs and imagery as evidence of teaching knowledge that is special. They are often critical of what people learn about teaching through living and working but find little redeeming in formal training either. At times, they act as if teaching has not yet been invented.

These theorists are both right and wrong: wrong to disregard or dismiss the folkways of teaching, right to make troublesome inquiries; right to believe that there can be more to teaching than common sense, wrong to assume that the private beliefs of teachers must be held for good reasons. Where found to be lacking, the question is what to substitute for the lights that teachers live by and how to go about setting teaching in a new light. Being more clear about teaching knowledge, about how it is held and used and where it comes from, will help in answering that question.

Categories of teaching knowledge. This analysis considers four categories of teaching knowledge, namely, the "folk-ways of teaching," "local mores," "private views," and "teaching expertise." Although these categories can be specified and characterized separately, they are not independent. Each category has a different focus: general patterns of usage, local customs, idiosyncratic variation, and reflective--hence critical, on occasion inventive--mastery. Of the four categories, three highlight sources, and one a quality or kind of knowing. More often than not, the folkways, local, and personal teaching knowledge are held as opinion, guesswork, and mere tradition, being acquired by habit, false inference and simple internalization, which turns patterns of action and interpretation into things "no longer easily accessible to reflection, criticism, modification or expulsion" (Schwab, 1976, p. 37).

The folkways of teaching describe "teaching as usual," learned and practiced in the half-conscious way in which people go about their everyday life. These folkways of teaching are typical; in contrast to the theories of scholars, they are patterns of action and interpretation that exist, are considered right, and are mostly uncodified. Capable of being practiced without understanding their point or efficacy, the folkways are widespread and emblematic, expressing in symbol and action what teaching is about. They are warranted by their existence and taken-for-granted effectiveness. Using the term "folkways of teaching" thus involves claims of existence, typicality, rightness, and half-conscious habit. It is here that the knowledge base of teaching lies. The folkways have their correlates in the character of school knowledge, that is, in the content and structure of what children learn in school.

Local mores constitute teaching knowledge held and used like the folkways and mostly based on them, but more variable and likely to be articulated as maxims or missions. Teachers' private views are like Bacon's (1620/1939) "idols of the cave." Personally compelling, they arise from the peculiar experiences, feelings, and characteristics of individuals who nevertheless are members of groups; hence even idiosyncrasy is socially colored and bounded. For these three sources of teaching knowledge, "familiarity, common repute, and congeniality to desire are readily made the measuring rod of truth" (Dewey, 1916/1963, p. 188).

What marks off teaching expertise from the folkways, local mores, and private views is less what associated knowledge is about than how it is held and used. Though it can build on the folkways, teaching expertise goes beyond their mastery or skilled performance by including (a) judgments of appropriateness, testing of consequences, and considerations of ends, not just means and (b) less typical modes of practice, such as explanation, discussion and the deliberate management of value dilemmas by the teacher. In how they arise and change, local mores and private views have more affinities to the folkways than to teaching expertise. Thus, while expertise can also grow out of local mores and private views, the odds are against it. In itself variable, teaching expertise is the exception by way of character and rare occurrence.

Drawing on research on teaching, teacher thinking and the cultures of teaching (including teacher education) in the United States, this analysis deals with each category in turn, examining what that knowledge tends to be about, how it arises and changes, how it is held and used, what it allows teachers to do and see, and how it may relate to the other categories. This discussion then leads to speculation about the ways in and extent to which these different categories of knowledge provide light that teachers live by. Are they inspirations or means of subsistence? How and why do the folkways of teaching, on the whole, account for the aspects in and by which teaching is viewed and practiced? When do teachers rely on their own lights, teaching and seeing teaching with the help afforded by their private views? To what extent do teachers live by the light of local mores, of what they learn by working in a particular setting? How bright or dim are these different lights, and how are old lights in teaching changed by new ones, if at all? Given this larger context, this paper on the folkways of teaching has been completed and will be presented at the upcoming meeting of the International Study Association on Teacher Thinking, Leuven, Belgium, October 1986.

Implementation of Teacher Thinking Research as Curriculum Deliberation[2]

Drawing on philosophy, curriculum theory, and studies of teacher education, this paper aims to reconstruct the implementation question in teacher thinking research. To exemplify our argument and show what is entailed in curriculum deliberation for teaching teachers, we examine a particular study of teacher thinking, Dan C. Lortie's (1975) SchoolTeacher, and a specific occasion for educating teachers, the "social foundations" course that is a part of American teacher preparation. Through a combination of philosophical and case analysis we aim to demonstrate that curriculum questions in teacher education are problems of practice, that is, of principled thought involving particulars, as opposed to technical application of research or unreflective reliance on tradition. Hence this paper serves to clarify the meaning of professional action in teaching teachers.

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[2] Zeuli, J.S., & Buchmann, M. (in press). (Occasional Paper No. 107). East Lansing: Michigan State University; also forthcoming in Journal of Curriculum Studies.

This paper to be published as part of the IRT series will also be presented at the upcoming meeting of the International Study Association on Teacher Thinking, Leuven, Belgium, October 1986.

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KNOWLEDGE USE IN LEARNING TO TEACH

This project has focused on how prospective teachers construct knowledge about teaching over the course of their preservice preparation. From 1982-1984, the project followed seven elementary education students through two years of undergraduate teacher education. The students were enrolled in two contrasting programs that are part of an effort to reform undergraduate teacher education at Michigan State University. The project has sought to describe and analyze what the prospective teachers learned in relation to what they were taught and to appraise that learning in terms of a conception of the central tasks of teaching and teacher preparation.

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KNOWLEDGE USE IN LEARNING TO TEACH

Background

Over 20 years ago, Sarason, Davidson, & Blatt (1962) called teacher preparation an "unstudied problem" and urged researchers to look at what actually went on inside programs as a basis for understanding the effects on teachers. Ten years later in a National Society for the Study of Education Yearbook on Teacher Education, Fuller and Bown (1975) recommended that researchers start trying to answer the basic descriptive question, "What is out there?" And most recently in her chapter on research in teacher education in the third Handbook of Research on Teaching, Lanier (1986) emphasized the need for descriptive-analytic studies of the teacher education curriculum and of the thinking and learning of teacher candidates.

Without systematic descriptions of what is taught and learned in formal preparation and field experiences, we cannot understand what professional education contributes to teachers' learning and how that learning can best be fostered. That means finding out:

1. What teacher educators teach;
2. How opportunities for learning in the preservice curriculum are structured;
3. What sense intending teachers make of these opportunities to learn over time;
4. What happens when student teachers take their learning from the university setting to the classroom; and
5. How these different experiences do or do not add up to a preparation for teaching.

These questions have shaped the Knowledge Use in Learning to Teach Project.

Assumptions and Purposes

We began the study with some grounded assumptions about the preservice phase of learning to teach (Feiman-Nemser, 1983). Generally regarded as a weak intervention, teacher preparation is a brief period of formal study. It is preceded by a long period of informal learning through teacher watching and classroom participation as a pupil, and succeeded by another period of informal, on-the-job learning. To be effective, teacher preparation must take into account the prior beliefs of candidates and also prepare them to learn from teaching in ways that go beyond trial-and-error and reliance on personal preference. The possibility that teacher education can make a difference implies that what candidates bring to their formal preparation by way of personal beliefs and dispositions may not be adequate and can be altered. It also suggests that teacher educators have worthwhile knowledge and skills to impart.

One goal of the study was to describe and analyze what prospective teachers learned in relation to what they were taught, both at the university and in the field. A second goal was to appraise the content and import of the lessons learned and consider if and how they added up as preparation for teaching.

Relationship to Previous Research

This study differs from previous research on teacher preparation in three major ways. First, there has been little research on the preservice curriculum, especially as it is enacted. While some researchers have investigated the effects of particular program components (e.g., student teaching), few have looked closely at education courses or other field experiences. Mostly they have drawn inferences about the "treatment" on the basis of pre/posttest data. In our study, we have focused on how the prospective teachers changed and on the nature of their professional education. This enabled us to speculate about the relationship between program features and teacher learning.

A second unique characteristic of this project is its longitudinal perspective. Most studies of teacher education look at prospective teachers at a specific point in their preparation (e.g., before and after student teaching); we have followed intending teachers through two years of undergraduate teacher preparation. This perspective allowed us to examine change over time and to explore how those changes relate to entering beliefs and program characteristics.

A third difference lies in our explicit commitment to description and appraisal. Most studies of teacher education tend to provide either description or evaluation. We wanted to document how prospective teachers construct knowledge about teaching over the course of their formal preparation. At the same time, we wanted to consider the empirical realities of teacher preparation in relation to a view of worthwhile ends and defensible means. Those realities do not speak for themselves. Researchers, policymakers, and educators need standards for describing and assessing what goes on in teacher preparation.

This report summarizes four years of work. It is organized into two main sections. In the first, we describe what we did; in the second, we discuss what we have learned about the preservice phase of learning to teach.

Research Design and Methodology

Selection of Sites and Participants

Sites. We chose as research sites two contrasting teacher education programs because we thought that differences in their structure and ideology might help explain differences in student teachers' thinking and learning. The Academic Program emphasized the importance of theoretical and subject matter knowledge in teaching. At the time of the study, it provided limited field experience prior to student teaching. The Decision-Making Program emphasized generic methods of teaching and research-based decision making. Mostly it took place in local elementary schools where teacher candidates spent considerable time in classrooms, aiding, observing, and teaching lessons. Both programs were part of a major effort to reform undergraduate teacher education at Michigan State University.

Participants. We selected four students from each program, using a two-step process. First, we consulted with program faculty who identified a pool of first-term elementary education majors. Second, we examined the students' responses to selected items on a questionnaire administered by MSU's Office of Program Evaluation. These included questions about sources of knowledge in learning to teach, reasons for wanting to become a teacher, degree of confidence in present and future teaching ability, and reasons for pupils' academic success or failure in school. Because we planned to follow a small sample, we deliberately chose individuals with contrasting views to increase the range of responses to common program experiences.

Our participants were as follows:

Academic Program	Decision-Making Program
Danielle	#Betty
Janice	*Cathy
Linda	Molly
Susan	Sarah

All names used are pseudonyms.
#Betty changed to the Standard Program before student teaching.
*Cathy dropped out of school to get married after the first year.

Data Collection

Two main types of data were collected--observations of courses and field experiences, including student teaching, and interviews with our student-participants.

Course observations. Each term we observed a key aspect of the curriculum in each program. Where possible, we observed comparable courses (e.g., a pair of educational psychology courses, a pair of social studies methods courses). Observers attended class regularly, taking detailed fieldnotes about the content of the class and how it was presented, about the assignments and how they were evaluated, and about what the students and the instructor did or said. Altogether we documented eight courses or course/field combinations:

Academic Program	Decision-Making Program
Educational psychology	Educational psychology
Curriculum	Reading methods #1
Social studies methods	Social studies methods
Science methods	Reading methods #2

The fieldnotes were typed and collated in sets by course, along with syllabi, student handouts, and tests. The course data provide detailed information about the enacted curriculum in core courses of two "alternative" undergraduate teacher education programs.

Interviews. Each term we interviewed our focal students about what they were learning in their education courses and field experiences and how they thought it would help them in teaching and learning to teach. The interviews probed students' perceptions about specific features of courses we had observed. For example, when we observed social studies methods courses where instructors presented many teaching suggestions and activities, we wondered what this communicated to students about the nature and sources of "good ideas" in teaching. We turned our musings into interview questions about where good ideas come from and how you can tell if something will "work." Observing in courses also gave us concrete, shared referents to talk about with students. Each participant was interviewed eight times over two years (not including student teaching). All interviews, which lasted about an hour and a half, were tape-recorded and transcribed.

Student teaching. Our research design also called for intensive study of student teaching. We expected that the character, quality, and outcomes of the experience would result from the interaction of program features, characteristics of the classroom and characteristics of the individual student teacher.

Each student was paired with one project researcher who visited the student teacher at least once a week and also interviewed her informally throughout the term. For each participant, the data included detailed fieldnotes of the student teacher's activities and interactions; records of all conversations with the student teacher, cooperating teacher, and university supervisor; and copies of the student teacher's journal. We also conducted two formal interviews at the beginning and end of student teaching.

Ongoing Literature Review

We reviewed literature on an ongoing basis, either in response to our orienting questions or to issues that emerged from the data. This work informed data collection and data analysis and contributed to the conceptual frameworks that are major outcomes of the study.

Knowledge use in teaching. Teacher preparation is supposed to be a time when future teachers encounter a knowledge base for their work. We were interested in the kinds of knowledge that teacher educators in different preservice programs would deem important for prospective teachers to acquire. We hypothesized that these encounters with theoretical and practical knowledge might influence how future teachers came to think about the role of theory and practice in teaching and learning to teach.

To explore these issues, we examined three categories of literature related to knowledge use in teaching: (a) empirical studies of teachers' knowledge (e.g., Elbaz, 1983; Huberman, 1980; Jackson, 1974; Lampert, 1981), (b) descriptive accounts by teacher-researchers about the role of theory in practice (Cazden, 1976; Duckworth, 1972), and (c) philosophical analyses of issues related to knowledge use in teaching (e.g., Buchmann, 1982; Dewey, 1904/1965; Phillips, 1980; Schon, 1983).

This literature challenges the dominant view of professional behavior as the application of scientific knowledge to the solution of practical problems. At the same time, it portrays teachers' patterns of knowledge use as intuitive and individualistic. Our review sensitized us to ways in which both programs seemed to misrepresent actual and desirable patterns of knowledge use in teaching (see Feiman-Nemser & Ball, 1984).

Conceptual change. We also wondered how the two programs would portray the process of learning to teach and whether this would illuminate the transition from layperson to teacher which we came to see as an important consideration at the preservice level. Because this transition requires new ways of perceiving and thinking about classrooms and teaching, we turned to the literature on conceptual change for ways to describe and account for the learning involved (e.g. Petrie, 1982; Strike & Posner, 1985). From this perspective, knowledge grows out of the interaction between experience and current ideas, and learning results from a change in cognitive organization. The conceptual change literature gave us ways to talk about changes in the thinking of our focal students as they encountered new ideas about teaching that did not match their prior beliefs. Other models of teacher learning (e.g. behavioral, developmental, socialization) do not illuminate such changes or provide direction for thinking about appropriate conditions. Our review of the literature on conceptual change refined our questions about teacher learning during teacher preparation and focused our attention on opportunities for and instances of conceptual change in our data.

Textbooks and curriculum decision making. A third major literature review was stimulated by an issue that emerged from our data. As we sat in on courses, we were struck by the fact that both programs seemed to promote the idea that good teachers did not use textbooks and teachers' guides, but developed their own curriculum instead. Surprised by this message, we turned to literature on elementary school textbooks (e.g., Duffy, Roehler, & Putnam, 1986; Durkin, 1981; Kantor, Anderson, & Armbruster, 1983; Schmidt, Caul, Byers, & Buchmann, 1984; Smith & Anderson, 1984) to see why teacher educators might want to steer teachers away from them. This research reports many deficiencies in school text materials, including badly designed practice materials (Sykes, 1985), unclear teachers' manuals (Durkin, 1981), and lack of attention to common student misconceptions about the content (Smith & Anderson, 1984). We also studied descriptive and analytic work on curriculum decision making (e.g., Anyon, 1981; Ben-Peretz, 1984; Buchmann, 1986; Cusick, 1983; Scheffler, 1958; Schwille et al., 1983) to help us develop a conceptual framework for thinking about what beginning teachers need to learn in order to make decisions about content and materials of instruction (see Ball & Feiman-Nemser, 1986).

Data Analysis

Data analysis has been ongoing, combining the use of external perspectives with the pursuit of emergent themes through interviews and fieldnotes. This strategy is based on two assumptions: that "seeing is something we do with ideas as well as with senses" (Strike & Posner, 1985), but also that learning something new is dependent upon one's capacity for surprise (Scheffler, 1977).

We developed some analytic schemes inductively. For example, in our work on how teacher educators portray the role of knowledge in teaching, we read through the fieldnotes, noting all explicit messages about the nature, sources, uses, and warrants of knowledge in teaching and learning to teach. Then, we grouped these messages into two distinct views. Finally we chunked each class period into segments and calculated the relative frequency of each view across a particular course (see Feiman-Nemser & Ball, 1984). Although we brought our interest in this issue with us to the study, our approach to data analysis was firmly grounded in the data.

We analyzed other issues by applying a set of questions based on reviews of relevant literature. For instance, in analyzing what programs conveyed to students about textbooks and curricular decision making, we framed four broad questions with which to examine the courses and used them to summarize the program messages (see Ball & Feiman-Nemser, 1986). In contrast to our work on views of knowledge, this issue emerged from the data and surprised us; yet our approach to analysis drew heavily on external perspectives.

We approached the student teaching data with questions about the influence of the program, the classroom setting, and the students' entering beliefs and expectations. We wanted to document the unique experiences of each student teacher in a way that would allow for comparisons within and between programs. We also wanted to draw on our extensive knowledge of programs and students in helping to explain what the experience was like and what student teachers learned. We evolved a common format for 15-20 page case studies that would stand alone as an account of each student teacher's experience. The format allows us to illustrate the relative influence of persons, program, and setting and to appraise the content and outcomes of the experience.

What We Have Learned

The outcomes of our project can be classified as frameworks, findings, and perspectives. Through the project, we have generated new ways of thinking about the role of formal knowledge and first-hand experience in learning to teach and about the special mission of teacher preparation. The longitudinal study of six prospective teachers also yields insights about what undergraduate teacher preparation is like and how teacher educators and prospective teachers think about it.

Frameworks for Appraising the Character and Quality of Teacher Preparation

Over the course of the project we have developed two frameworks for thinking about teacher learning during teacher preparation. One focuses on central tasks of teacher preparation; the second elaborates sources of influence on teacher learning during teacher preparation. The frameworks allow us to integrate empirical description with an analysis of questions of value and policy in teaching teachers (see Scheffler, 1985, for a discussion of the role of such frameworks in educational research). Together these frameworks offer a perspective on the special role of teacher preparation during the preservice phase of learning to teach. They focus attention on the extent to which prospective teachers become oriented to the distinctive work of teaching and begin to develop the understandings and practical skills that their work requires and they highlight the sources of influence on teacher learning.

Central Tasks of Teaching and Teacher Preparation

What is the special mission of preservice preparation? Our answer rests on an epistemic view of teaching (Jackson, 1986) which points to a major goal for preservice preparation--helping prospective teachers make a transition to "pedagogical thinking." The sorts of changes involved in this transition from common sense to professional modes of thinking go beyond the acquisition of subject matter knowledge and technical skills.

What distinguishes teaching from other helping professions is a concern with helping people learn worthwhile things in the social context of classrooms. Whatever else teachers do, they are supposed to impart knowledge and see that pupils learn (Wilson, 1975; Peters, 1977; Buchmann, 1984). To promote learning, teachers must know things worth teaching, consider what is important, and find ways to help students acquire skills and understandings. This calls for principled and strategic thinking about ends, means, and their consequences, as well as consideration of the skills and motivation to implement particular courses of action.

Since teachers cannot observe learning directly, they must learn enough about people to detect signs of understanding and confusion, feigned interest and genuine absorption (Dewey, 1904/1965). Because teachers work with groups of students, they must also consider the learning needs of many individuals as they orchestrate the social and intellectual sides of classroom life. Good teachers at their best moments manage both sides together whereas novices usually cannot give them equal attention at the same time. By concentrating on the interactive side of classroom teaching, however, student teachers may learn to manage pupils and classrooms without learning to teach (Dewey, 1904/1965).

Pedagogical thinking and acting. Although the lengthy personal experience of schooling provides teacher candidates with a repertoire of beliefs and behavior to draw from, it does not prepare them for the central tasks of teaching. Looking at teaching from a pupil perspective is not the same as viewing it from a pedagogical perspective. Prospective teachers must learn to look beneath the familiar, interactive world of schooling and focus on student thinking and learning. Perhaps most difficult is learning to shift attention from oneself or one's subjects to what _others_ need to learn.

There is a big difference between going through the motions of teaching--checking seatwork, talking at the board, assigning homework--and connecting these activities to what pupils should learn over time and checking on what they have actually understood. Helping prospective teachers recognize that difference and laying the groundwork for the orientations and skills of pedagogical thinking and acting are central tasks of teacher preparation.

Teaching in a multicultural society. Puzzling about what is going on inside the heads of young people is difficult enough when teachers and students share a culture; it becomes even more complicated when they do not. Yet teachers must assume some responsibility for equal access to knowledge. This requires, in addition, that they examine their own beliefs about the capacities and needs of different pupils and pay attention to the effects of various teaching strategies on them.

Prospective teachers are not likely to approach their teacher education in this way. Consider the qualities they think are important for teaching and their expectations about what they will learn from their professional studies. They typically cite warmth, patience, and a love of children as personal qualities that will make them effective teachers. They expect to teach youngsters like themselves in schools that are like the ones they attended. Often they think that common sense and memories from their own schooling will supply the subject matter necessary to teach young children. They most hope to learn instructional techniques and methods of classroom control through formal preparation.

Teacher educators cannot ignore the expectations and personal qualities of candidates but must relate them to a view of teaching and learning to teach in which student learning and understanding is central. They must help prospective teachers connect their reasons for teaching to the central tasks of teaching and see that decisions about content and pedagogy have social consequences for which they as teachers are partly, responsible (Scheffler, 1958). Our case studies of teacher learning and teacher preparation illuminate and are illuminated by this framework.

Sources of Influence on Teacher Learning During Teacher Preparation

A second framework which we have developed describes major sources of influence on teacher learning during preservice preparation and how they help or hinder the transition from lay person to teacher. These sources of influence include the personal capacities, temperaments, and entering beliefs of teacher candidates and their opportunities to learn in professional courses and field experiences, especially student teaching.

Most models of learning to teach emphasize the role of a single source of influence on teacher learning. For example, theories of teacher development focus on individual teachers' capacities and concerns that presumably unfold in a succession of stages through experience over time (e.g. Fuller, 1969). Theories of teacher socialization emphasize the influence of the school setting in which teachers are influenced by colleagues, pupils, and the work itself (e.g. Waller, 1932). Theories of teacher training highlight a process of practice and feedback meant to equip teachers with a repertoire of skills and strategies (e.g. Joyce & Showers, 1980).

These models have no clear connection to the central tasks of teaching and teacher preparation. The developmental and socialization accounts do not accord much of a role to teacher educators, focusing instead, on the teacher as a person and the workplace as a setting. The training account presupposes a limited idea of teacher performance and treats learning to teach as an additive process that largely bypasses person and setting. None of the models illuminates the role of previous beliefs or "preconceptions" in teacher learning. Nor do they take into account the "ecology" of teacher education--the influence of program features, settings, and people as they interact over time (Hersh, Hull, & Leighton, 1982). Failure to attend to this "ecology" is a major reason for the unsatisfactory state of knowledge about teacher preparation and learning to teach (Zeichner, 1985).

In our project we examined the _thinking_ of future teachers in relation to the _content_ of the preservice curriculum and the _context_ of the schools in which they work as student teachers. Because we assumed that opportunities to learn and learning outcomes result from the interactions of persons, programs, and settings, we focused our work on describing and analyzing the patterns of interaction among three sources of influence.

Persons. We have already acknowledged that prospective teachers perceive and interpret the preservice curriculum in terms of their preconceptions about teaching and learning to teach. Teacher candidates also have personal dispositions, orientations, and experiences relevant to teaching. Qualities such as social and intellectual skills and expectations about life and work affect the way they approach their preparation and influence what they learn from it.

Programs. Typically, teacher education programs rely on the arts and science faculty to provide teachers with general education and subject matter knowledge. Education courses are the most formal and systematic part of learning to teach. In teacher education courses, future teachers are exposed to the knowledge presumed to be relevant to teaching. Foundations courses generally draw their content from the disciplines undergirding education (e.g.

psychology, sociology, philosophy) and, more recently, from research on classrooms and teaching (Smith, 1980). Methods courses focus on approaches to teaching different school subjects.

Some courses have associated field experiences during which teacher education students "apply" the knowledge they are learning to teaching situations. What teacher candidates learn in their education courses, however, depends not only on the knowledge they encounter but also on the way those encounters are structured and the messages they convey about teaching and learning to teach.

The "field". Teachers often regard student teaching as the most valuable part of their formal preparation. As a model of classroom life and an arena of practice, the "field" influences the boundaries and directions of what can be learned through its characteristic interactions and curriculum. Cooperating teachers set the affective and intellectual tone in classrooms and demonstrate ways of working with pupils. They can also influence what student teachers learn by the way they conceive and carry out their roles as teacher educators (e.g., by the responsibilities they assign and the feedback they offer). The ethos of the school and the norms that govern faculty interactions are other potential sources of influence on teacher learning.

Our case studies of student teaching illustrate how these factors of persons, program, and setting interact over time to affect differentially the experience of each of our students. They challenge the conventional belief that the the school is a powerful conservative force that "washes out" the desirable effect of the university program. Questions of relative influence, interaction, and effect are far more complicated than this conventional image suggests.

Findings and Perspectives

The Epistemology of Teacher Preparation

The underlying epistemology of teacher preparation treats educational research and theory as the major sources of knowledge about teaching and views the "field" or classroom as a place to apply formal knowledge. Despite their differing ideologies and structures, both programs promoted these views even though they did so in strikingly different ways.

The Decision-Making Program approached the field head on. Involving the students in classroom work on a continuing basis, faculty worked actively to shape the content and outcomes of this experience. The program coordinator selected one local elementary school as the site for first-year field experiences and another one for student teaching. The program "moved in," occupying a classroom for its seminars and classes, and placing Decision-Making Program students in most of the school's classrooms as assistants. The program used detailed forms to evaluate the lessons that prospective teachers' taught based on course concepts. During student teaching, the program coordinator spent large amounts of time in the school, directly supervising and evaluating students.

In contrast, the Academic Program avoided the field. Students had limited and specific field assignments in connection with particular courses (e.g., conducting a clinical interview with a pupil). Student teaching was their first extended time in a classroom. In place of firsthand experience, several courses used case studies of teaching and learning to illustrate concepts and provide vicarious experience. Still students were expected to operationalize these concepts during student teaching without having had much help in clarifying their practical import and mastering the requisite skills.

Student teachers in both programs were supposed to "use" what they had been taught in their university courses in the classrooms just as "professional teachers" use research and theory to make teaching decisions. At the same time, both programs seemed to underestimate what is entailed in learning to do this. Nor did they explicitly promote the idea of "learning from experience." Student teachers were evaluated on their performance without having opportunities to achieve technical mastery let alone work on transferring skills to the real world of the classroom. Although they were told that learning to teach would continue on the job, students were not judged on their willingness to take a critical and experimental stance toward teaching.

Neither program taught students about the role of practical knowledge in teaching, and students in both programs developed the idea that most practicing teachers were not desirable models nor sources of knowledge. Sarah, one of our focal students, commented about the teachers in school--they "can't help it if they don't know about some of these things--like metacognition-- 'cause they weren't in the Decision-Making program in 1982." Instructors and supervisors directly reinforced this view. One supervisor in the Decision-Making Program told a student that "quite frankly . . . this is what will make you different than the average teacher."

Even though Academic Program students were not in the field, they read and criticized cases of teachers who seemed to focus on activities rather than on student learning. During student teaching, several student teachers were highly critical of their cooperating teachers and rejected them as sources of knowledge about teaching.

Despite the emphasis on knowledge use, students still developed a "trial and error" approach to teaching, believing that they would have to figure out for themselves "what works." Janice, an Academic Program student, tried to get help from her cooperating teacher with classroom management, a topic not addressed by her program. She was told: "I can't tell you exactly what I do because each person develops their own thing. I can't tell you exactly what to say. It'll come to you." Our students came to see the process of figuring out "what works" as highly individualistic, without need of professional standards for judging the adequacy or defensibility of particular ideas, strategies, or approaches.

The epistemology of teacher preparation that we uncovered sets up a curious paradox. On one hand, prospective teachers are enjoined to apply a commonly shared body of scientific knowledge. On the other hand, their individualistic approach to teaching is reinforced rather than challenged. Our research suggests that the university is just as responsible as the schools for fostering individualism in prospective teachers rather than helping them develop an explicit sense of professional or role-related standards against which to judge their work.

The Neglect of Subject Matter in Teacher Education

Prospective elementary teachers tend to have limited knowledge of their teaching subjects. None of our students had a solid grounding in any subject, and some of them disliked certain subjects. Whereas the two programs differed in their view about the role of content knowledge in teaching, neither program helped (or even encouraged) students to build up their subject matter knowledge.

Instructors in the Academic Program stressed the importance of having a "solid grasp" of subject matter (e.g., understanding the central concepts in a discipline and the relationships among them). They portrayed teachers as decision makers about what topics to emphasize, touch on, and omit, decisions that depend on an understanding and conception of the subject matter. The Academic Program also promoted a view of teaching in which teachers focus on student thinking and teach for understanding. According to this view, teachers should identify and seek to change pupils' naive conceptions. To do this kind of teaching, one instructor noted, teachers must know a lot.

Whereas instructors in the Academic Program stressed the centrality of subject matter, course assignments seemed to assume that prospective teachers already had sufficient grasp of their subjects. In one course, for instance, students worked in groups to develop a "spiral curriculum" for a central topic in their subject area (e.g., heat in science, the number system in mathematics, conflict in social studies, and character in English). This task, which requires an understanding of the basic concept and its elements, proved difficult for many students. The mathematics majors, for instance, struggled with the idea of "number system" since it did not fit the ways in which they tended to think about math (e.g., in terms of "courses" such as algebra or geometry). The Academic Program students also had to critique textbooks in two of their "core" courses, assignments that assumed a fair degree of subject matter expertise. In one assignment, the instructor asked students to determine whether a textbook in their subject area contained content that was "important" for students at a given age to know. He assumed that the prospective teachers had a sufficiently broad perspective on their subjects, such that they could evaluate the relative worth or centrality of certain ideas or skills. In fact, many students had to rely on their recollections of what they had learned when they were in the same grade.

Unlike the Academic Program, the Decision-Making Program did not emphasize subject matter knowledge, promoting instead a geneeic, process view of teaching. It projected an image of the good teacher as one who makes systematic, data-based decisions, drawing from educational psychology and research on teaching.

Planning was a major emphasis of the Decision-Making Program, and the way in which it was taught revealed the program's stance toward subject matter knowledge. In teaching the skills of instructional planning, one instructor said, "A behaviorial objective can be described for any subject, even if the one writing it doesn't know the subject." Lesson plan assignments treated planning as a generic process, based on principles from educational psychology (e.g., Piagetian stages, advance organizers) and unrelated to subject matter considerations. During student teaching, supervisors worked hard to help student teachers improve their planning but did not help them understand the content they were teaching (see case studies of student teaching, especially Sarah in Feiman-Nemser, Ball, Buchmann, Noordhoff, & Lawrence, 1986).

In both programs, the prospective teachers' lack of subject matter knowledge was evident during student teaching, yet no one--not the university supervisors nor the cooperating teachers--seemed to focus on this. For example, one day Janice, struggling with an impromptu digression, told her second graders that the idea "one fourth of 100" could be written:

$$1/4 \div 100$$

Another day she got stuck as she tried to think of a model or story that would help seven-year olds understand negative numbers. Rather than helping Janice understand the concepts she was supposed to teach, the cooperating teacher told Janice not to focus so much on content but to worry more about management. Similarly, when Sarah began teaching fifth graders about place value, her university supervisor pushed her to do her "own" planning instead of relying on the math textbook. While the supervisor urged Sarah to "think conceptually," Sarah was confused about the essential concept. Whether she assigned exercises from the book or used chip-trading activities, she had trouble understanding and teaching the concept of place value, but the help she received from her supervisors centered on planning.

Despite different messages about the centrality of subject matter knowledge in teaching, neither program directly addressed the teacher candidates' understanding of the subjects they were supposed to teach. This finding may help account for why elementary teaching is often thin and tends to be judged according to generic, process criteria. It also highlights a critical problem in the current organization of and responsibility for teacher education. Most of the official responsibility for subject matter preparation lies outside teacher preparation. Yet liberal arts faculty are unlikely to feel responsible for teaching subject matter in ways that foster the special kind of understandings that teachers need (Wilson & Shulman, in press). Moreover, teacher educators, who control only a small proportion of prospective teachers' total education, are unlikely to add subject matter to their responsibilities. The view of pedagogy as a generic process perpetuates a basic weakness in undergraduate teacher preparation that no on seems to feel responsible for.

Learning to Use (or Not Use) Textbooks and Teachers' Guides

Both programs promoted the idea that professional (i.e., good) teachers did not use textbooks and teachers' guides but developed their own curriculum instead. Following a textbook was portrayed as an undesirable, "low-level" way to teach. Neither program directly taught students how to choose among the many pieces of a curricular program or modify teaching suggestions and activities to meet the needs of particular children.

Our focal students developed the impression that their own ideas and knowledge were a better source of content than anything in a textbook or teacher's guide. In preparation for their role as curriculum developers, they were not helped to think about what counts as a "worthwhile" learning activity.

Neither program dealt with the policy dimension of curricular decision making. Many teachers work in situations where district policy mandates the use of a basal series and where curriculum is controlled through objectives and standardized testing. Still, the teacher education programs conveyed the impression that good teachers were autonomous professionals.

The issue of textbooks became particularly important during student teaching as our students grappled with the mandate to avoid textbooks and teachers' guides. In spite of what they had been taught in their courses, the student teachers in both programs ended up using basals and teachers' guides. Five out of six of our students were placed in settings with cooperating teachers who used textbooks as the core of their reading and mathematics teaching. Some of them felt pressed to maintain the established classroom practice. Others, as they assumed responsibility for the entire day, were simply overwhelmed, and resorted to textbooks as a reasonable way to manage, or at least survive, the demands of full-time student teaching.

One surprising finding was that following the teachers' guides presented unexpected problems for the student teachers. Some discovered that they were unprepared to use textbooks and teachers' guides to teach subject matter. Others followed the teachers' guides rather mechanically, moving through activities without really understanding what they were doing. Because they did not adapt what was in the teachers' manuals, their modifications sometimes distorted the point of the lessons.

The difficulties encountered by our students as they tried to teach with and without textbooks suggested to us that the goals as well as the methods of teacher education in this area need to be reconsidered. It led us to develop a position about what preservice teacher education ought to consider (see Ball & Feiman-Nemser, 1986). The position addresses a basic dilemma in teacher education and outlines four aspects of planning that should be considered in thinking about what to teach prospective teachers about textbooks and teachers' guides.

A basic dilemma in teacher education: Preparing teachers to adopt or to change current practice. Teacher educators, critical of prevailing school practices, often view teacher preparation as a vehicle for introducing change. Many would agree that schools of education must not prepare prospective teachers to fit in with schools as they are. At the same time, teacher education students are novices who cannot be expected to spearhead school reform; their needs and abilities must be viewed from a perspective of learning to teach (Feiman-Nemser, 1983). Translating ambitions for school improvement into immediate goals for beginners can have problematic consequences for teacher effectiveness and teacher learning.

The issue of beginning teachers and textbooks provides a concrete example of this basic dilemma in teacher education. On one hand, textbooks and teachers' guides are often poor; on the other hand, beginning teachers lack subject matter and pedagogical knowledge and may need guidance (e.g., activities and ideas for organizing the content) as they begin teaching. The issue of what to teach novice teachers about the use of published curricular materials cannot be reduced to a simple choice between trying to change schools or preparing beginners to fit in. In managing this dilemma, teacher educators must combine a view of desirable practice with a realistic perspective on what is appropriate for beginning teachers.

A sensible goal for preservice teacher education. The position we have developed identifies four aspects of planning (with or without textbooks) that should be considered in thinking about what to teach prospective teachers about textbooks and teachers' guides:

1. Justifying decisions in teaching
2. Understanding content and pedagogy
3. Implementing curriculum
4. Learning to learn from curriculum materials

First, it is not enough to tell prospective teachers who lack knowledge and experience that they should not follow teachers' guides but should be curriculum developers and decision makers who create their own plans. Beginning teachers must learn to think hard about appropriate bases for curricular and instructional decisions, so that they do not rely on their own preferences (Cusick, 1983; Buchmann, 1986), commonsense views of what is meaningful or "fun" (Dewey, 1938/1977; Floden & Buchmann, 1984) or stereotyped notions of what particular students "need" or "can" learn (Anyon, 1981; Brophy, 1983). Since many instructional decisions that teachers make are within a policy context, prospective teachers must also be helped to understand, interpret, and work with district curriculum mandates.

Second, developing one's own plans requires a flexible understanding of the topic to be taught and ideas about how children can be helped to learn it. Teacher educators often assume that intending teachers know their subjects better than they do. Using teachers' guides can support beginning teachers, giving them ways to approach the teaching of academic content.

Third, teaching well even from a highly prescriptive curriculum is more complicated than many seem to appreciate. Beginning teachers must be helped to use textbooks and teachers' guides appropriately by learning how to get inside the curriculum as well as how to carry it out in a specific setting.

Finally, and perhaps most important, preparing prospective teachers to use curriculum materials well should not be the ultimate goal. Preservice teacher education must prepare teachers to go on learning from their teaching experience. Teachers' guides can provide a helpful scaffold for learning to think pedagogically about particular content. This kind of thinking is different from using a teacher's guide like a script. Beginning teachers must be oriented toward learning from curriculum materials, so that they can move toward being able to build their own units of study that are responsible to the subject matter and responsive to their students. This is a reasonable goal for teacher development, not a starting point for beginners.

Preservice Preparation as a Phase in Learning to Teach

Another perspective highlighted and elaborated by this project is that preservice preparation is not synonymous with learning to teach. Rather, it is a phase of formal study, preceded by a long "apprenticeship of observation" (Lortie, 1975) and succeeded by an intense period of learning on the job. This broad view has implications for the goals and content of the preservice curriculum. Additionally, when preservice preparation takes place in a university (or college), the possibilities and limits of this setting need to be considered. What aspects of professional knowledge can be learned most efficiently or effectively through formal study rather than on-the-job experience? What can be learned from the experience of working with pupils over time that is fruitless to study in a university seminar? When is experience a good teacher in learning to teach?

"Pitfalls" of Experience in Learning to Teach

Whereas experience can supply both the means and content of teacher learning, it is not always a good teacher. During preservice preparation, intending teachers are susceptible to three "*pitfalls*": (a) the familiarity pitfall, (b) the two-worlds pitfall, and (c) the cross-purposes pitfall (see Feiman-Nemser & Buchmann, 1985). The familiarity pitfall focuses on the fact that prospective teachers are no strangers to classrooms and tend to confuse what is familiar with what is necessary. The two-worlds pitfall focuses on potential conflicts between the expectations and rewards of the university and those of the school in evaluating prospective teachers. The cross-purposes pitfall highlights difficulties that stem from the fact that classrooms where prospective teachers undertake field experiences are not intended as settings for teacher preparation. Classroom teachers must concern themselves primarily with their pupils' learning; these responsibilities may interfere with fostering the learning of a visiting prospective teacher.

Many consider student teaching the most valuable part of experiential teacher preparation. Typically it is not viewed as an occasion for teacher learning; rather it is seen as a capping experience, the culmination of formal preparation. Thus student teachers are evaluated on their readiness to take on the responsibilities of teaching. But student teaching also marks a beginning in teacher learning. For the first time, the novice teacher is in a position to start constructing the kind of practical knowledge that can only be derived from interaction over time with pupils in classrooms.

Developing practical knowledge is not the same as "having classroom experience" and requires a different way of thinking about teachers' learning and teacher knowledge. Whereas student teachers certainly need opportunities to connect formal knowledge with the reality of working in classrooms, the prevailing emphasis on application and use of knowledge may divert attention from helping beginning teachers learn how to learn from teaching.

Dissemination

We conclude with a list of the products that have resulted from this project. In addition, we mention two other ways in which the Knowledge Use in Learning to Teach project has had a direct influence on the teacher education research and practice. First, the findings of the project have directly influenced two major changes in the Academic Program--the introduction of a mentor teacher component and the development of a new mathematics sequence for elementary education majors. We have on file letters from the program coordinator and faculty acknowledging our research as a source of stimulation and program modification. The project has also influenced the research agenda of the National Center for Research on Teacher Education where questions about teacher learning and teacher education are central.

Products of This Project

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TEACHERS' CONCEPTUAL CHANGE IN PRACTICE

A significant feature of recent debates about structural changes needed to improve public schools in the United States is that the roles and abilities of teachers are being discussed without systematic consideration of what teachers already know about their teaching and of what changes in their conceptions and practices they are capable if given the opportunity and guidance. This project was an intervention study designed to address the lack of teachers' input in decision making about educational reform at the local level.

The researchers worked closely with four experienced teachers and their principal by (a) engaging in dialogue with them about observed events in their classrooms and building and about their own reflections on their practice and (b) guiding them in writing about their implicit and changing conceptions of what they do. The teachers and principals reported on their experiences of change to a variety of audiences, both within and beyond the district, which had been identified as important in the process of bringing practitioners' reflections and insights into the center of staff development efforts in the district and into current discussions at the national level about reforms in teaching and teacher education. The research component of the study consisted of documenting (a) the processes by which teachers learn to reflect on, change, and write about their conceptions of their own teaching and (b) the ways in which their views influence district audiences' understanding of teachers' practical knowledge and its potential contributions to the district's efforts to improve instruction.

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TEACHERS' CONCEPTUAL CHANGE IN PRACTICE

Project Goals and Research Questions

For two years the participants in the TCCP project have been engaged in both implementing and conducting naturalistic research on an approach to staff development that combines the promotion of self-directed teacher growth with efforts to bring about the organizational changes necessary to support teachers' continued individual development and sense of professional identity. The major goal of this project was to see what changes in conceptions about and practices in classroom instruction would occur when teachers and their building principal were given the opportunity and support for (a) reflecting more deeply and systematically about their implicit knowledge as practitioners, and (b) communicating their insights and experiences of change to various audiences concerned with improving teaching and learning through staff development and organizational change.

In their role as participant observers in the classrooms of four early-grade teachers, six of the project researchers collected observational field notes, made audio and video recordings, and conducted informal interviews with the teachers concerning their views of their instructional practices and the changes in their views and their practices that occurred as a consequence of their work in the project. A seventh researcher (Navarro) had intense conversational interviews with the building principal concerning her emerging sense of her role as an instructional leader supportive of the teachers' self-directed change.

These various materials formed the basis for documenting what happened in this project. The materials also played a key role in the staff development approach itself, in that they provided the basis for three kinds of activities that appear to have been crucial to the changes experienced by project participants: (a) the writing and exchanging of reflective journal entries between the researchers and the practitioners, (b) the large- and small-group discussions that the project participants regularly held among themselves, and (c) the formal presentations that the teachers and principal made to diverse audiences.

This project has been unique in focusing its attention on both individual teachers and on building and district personnel. Teachers are seen as practitioners capable of becoming more reflective and articulate about their instructional strategies; the building and district are seen as organizational contexts that influence the ways in which teachers implement what they learn through staff development activities.

This dual focus is especially important because of differences in perspective and interest among various parties involved in staff development efforts conducted jointly by school districts and universities. These differences potentially obtain between (a) teachers and administrators, (b) school district personnel (teachers and administrators) and university staff, and (c) university staff in their roles as researchers and change agents. The scientific and educational importance of this project is that, by combining staff development with research on teacher professional development and organizational change, we have been able to explore relationships among characteristics of teachers, the organizational contexts of instruction, and the differences in perpectives held by those involved in planning, conducting, participating in, and doing research on staff development.

A distinctive feature of this work has been its view of the nature of educational reform. In the literature on school reform and in various efforts at curriculum innovation and staff development, it has often been claimed that teachers in U.S. schools are unusually resistant to change. An alternative view is possible: Teachers' reluctance to adopt new standard operating procedures can be seen not simply as recalcitrance or stupidity. Rather, their resistance can be interpreted as derived from a view of classroom practice that differs in fundamental, qualitative ways from views held by educational policymakers, curriculum developers, school administrators, and educational researchers.

Yet the teacher's point of view usually has little if any institutional status nor adequate supporting resources, especially time for reflection and the development of a community of discourse about teaching problems and their possible solution. The current organization of the teacher's work life does not stimulate reflection on what teachers already know, nor does it stimulate teachers to develop their conceptions further as their experience increases. Because school systems have not asked teachers to be accountable for how they think about their teaching, administrative procedures provide no significant place for teachers' own accounts of their practice. Currently, debates about criteria for appointment to master teacher status or for allocating incentives such as merit pay are taking place without systematic inquiry into what teachers actually know about their practice and how well they are able to articulate it to others. Consequently the distinctive perspective of the classroom teacher often is not articulated at all, and many teachers are becoming increasingly resistant to plans made by others for improving their practice.

One result of this at the local school level is a gap in perspective between teachers and administrators concerning the nature of daily life in classrooms and the implications of that life for the implementation of mandated policies and procedures. Neither the teacher, who has not been accustomed to speak or write on such issues, nor the administrator, who is not oriented to listening, can close this perspective gap readily. It follows that, if one is to take the practical wisdom of the teacher seriously in staff development, one needs to work not only with teachers to help them articulate and deepen their insights into practice but also with administrators to familiarize them with teachers' "bottom-up" view of school policy and classroom practice. We argue, in short, that administrative and organizational change must necessarily accompany teacher change as aspects of staff development.

There is also a gap in perspective between educational researchers and practitioners. The role of researchers in educational reform has typically been that of knowledge source. If educational reforms are "research-based," it is the researcher's knowledge about practice that is used to justify the continuation of practices or to warrant changes in them. This knowledge can be viewed by practitioners ambivalently--what researchers know can be considered authoritative, on the one hand, and naive, on the other.

Finally, there is a gap in perspective within the university staff person between the role of disinterested and detached observer and that of change agent with a stake in the changes that are occurring. This gap can lead to role conflict for the researcher and mixed messages conveyed to teachers and administrators.

Our combined staff development/research project has been an attempt to address these three gaps. In the project three first-grade teachers and a second-grade teacher engaged in activities designed (a) to enable them to uncover and reflect critically on their implicit and contextually embedded knowledge of their own daily practices and (b) to encourage them to articulate their emerging insights and to report on them to audiences variously concerned with improving instruction. The building principal participated in these activities and became both a key source of support within the building and a crucial link between the teachers and central district administrators. University staff learned to live with the tensions inherent in their dual roles as researchers and staff developers, while also broadening and deepening their own understandings of teachers' and administrators' perspectives on instructional problems. Overall, our goals have been to discover what the teacher has to say, to enhance the teacher's voice in saying it effectively to different audiences, and thereby to close the gaps between the different perspectives.

The following are the main research questions that guided us in documenting what happened in this project:

1. How is the planned intervention actually implemented?
    a. What actually happens in the interviews and discussion meetings between the researchers and the teachers?
    b. What happens in sessions with the district-level audiences?
2. What are the conceptual changes that occur as teachers articulate in writing their knowledge about and rationales for their teaching practices? To what extent do these changes occur in their tacit knowledge and in their conscious knowledge?
3. What are the reactions of the various audiences in the district to the teachers' reports?
    a. Are there regular differences across time in the reactions of those who have different roles and statuses in the district?
    b. In what ways do the conceptions of teaching held by members of the district audiences change across time?
4. What influence do the reactions of the district audiences have on the teachers' conceptions of their practice? Do these reactions stimulate further critical reflection and change or lead instead to defensive positions?
5. What influences does the work of this project have on the researchers? How do their conceptions of teaching practice, both within the classroom and as constrained by the local district as an organizational context, become more explicit and/or change?

Summary of Major Phases and Project Activities

Defining Issues, Establishing Relationships, and Beginning Activities (October 1984-June 1985)

The project formally began on October 1, 1984. During the fall of that year the project coordinators (Erickson and Campbell) began explorations with two local school districts about their willingness to be involved with the project, while the project research staff met regularly to plan how to begin classroom observations, reflective journal exchanges, and informal interviews once a group of teachers within one of the districts agreed to participate.

In January 1985, one of the district superintendents indicated that it was not a good time for his district to get involved with our approach to staff development. The other superintendent, however, conveyed his enthusiasm and that of his district staff to accommodate our project; the building principal and three first-grade teachers to whom he referred us similarly indicated their interest in becoming participants in the project.

During February, further meetings with the superintendent, principal, and teachers were held to clarify project goals and plan initial activities. We agreed on the levels of commitment of time and effort that each participant was willing to give to the project, while also establishing the district's willingness to provide release time to the teachers for their participation in meetings with the research staff. Even as we were at this early stage deferring decisions about how specifically to involve district level personnel in the project as the focus for addressing issues of organizational support and change for our work, we were also finding the building principal to be a person who was quite interested in participating in our activities. Her involvement throughout the project came to be an unanticipated but highly important feature of our efforts to facilitate the teachers' links with and influence on personnel, contexts, and constraints typically beyond their purview within the classrooms and traditionally beyond their sphere of direct control.

By late February 1985, project activities were well under way, in two main areas. First, the researchers began to visit the teachers' classrooms, to become acquainted with and to make observational field notes about daily classroom activities, and to have the basis for the initial exchange of journal entries with the teachers. For these visits and journal exchanges, three-person teams were formed, each consisting of two IRT project staff and one of the teachers (Erickson and Raphael with Teacher A, Campbell and Brown with Teacher B, and Torres and Kirschner with Teacher C).

Navarro and the building principal (Principal 1) constituted a fourth team; their activities consisted primarily of informal discussions about her emerging identity and goals in her first year as a principal. Navarro also made observations of Principal 1's daily routines, and he began attending district-level meetings with the principal and with the teachers in their capacities as building, grade-level, and/or subject area representatives.

Concurrent with this work at the team level was the second major area of activity, a series of group meetings involving all of the project participants. These meetings were to continue on the average of twice a month during each school year for the duration of the project. They focused variously on defining and refining the general goals of the project, specifying the topics and issues on which the teachers wished to direct their reflections and their journal exchanges with their IRT team members and sharing emerging insights about the nature of the teacher's conceptions and practices of teaching, as well as the ways in which their conceptions and practices were changing as a result of their reflections and their interactions with the researchers.

By the end of the 1984-1985 school year, we felt we had made important progress in our effort to implement and study a relatively open-ended and teacher-centered approach to staff development. Through our classroom visits, journal exchanges, informal interviews, and group meetings, we were gradually building and reinforcing the relationships of trust and the common frameworks for a community of discourse about the teachers' concerns. This would later carry us successfully through the more difficult stages of implementing the changes in classroom practice that would follow from the teachers' emerging insights about the nature of their teaching and about ways in which to improve it.

In our large-group discussions, we had begun with the teachers' avowed interest in addressing their dilemmas and frustrations with classroom management issues and their experiences of personal stress. They were especially concerned with the draining and demoralizing effects of their tendency to assume that they were "100% responsible" for every conceivable factor affecting their students' experiences in school, even as they acknowledged that they felt this way about matters which they realized they could not be held responsible for, such as the circumstances of a child's home and family situation. We were also beginning to see the effects and implications of the researchers' tendency to reconstrue the teachers' management and stress concerns in terms of substantive curricular and academic learning issues.

On the one hand, our collective delineation of the differing starting points that we took as practitioners and as researchers led us to agree that academic instruction and nonacademic management tasks were much more intertwined than our initial dichotomizing of "curriculum" versus "management" would suggest. These early discussions provided the foundations upon which the teachers were able, during the second year of the project, to effect changes in their organization of classroom instruction that both improved the quality of the children's learning experiences and ameliorated their experiences of stress and frustration over not fulfilling their self-imposed standard of "100% responsibility."

On the other hand, we were later to realize that these discussions exemplified important differences in perspective between the researchers and the practitioners, and thereby some crucial limitations and difficulties for the researchers in their adherence to their avowed commitments to having the teachers' definitions of problem areas for our joint work determine how we would proceed. Our relative lack of awareness at the time of this domain of perspective difference underlay later experiences of conflict and misunderstanding between the researchers and the practitioners, and among the researchers themselves. (See Campbell, Raphael, & Zietlow, 1986, for further discussion of the nature and impact of the perspective differences and role conflicts that characterized this project across its major phases of activity.)

Through the large-group meetings during the winter and spring of 1985, we also became increasingly aware of how the classroom-based activities of the project (i.e., the classroom visits and the informal discussions and journal exchanges about specific instructional events and issues) were beginning to have an impact on the teachers' thinking about their practice. In these early months of our work, the teachers were primarily becoming more aware of the complexity of their teaching and of their reliance on implicit knowledge in making the myriad of moment-to-moment decisions about what to do next for their students individually and as a group. At this point none of us could be very specific about the nature of this knowledge, although the researchers and teachers were gradually focusing on similar incidents of classroom life in their efforts to examine this knowledge through the classroom visits and journal exchanges. More importantly at this stage, we were encouraged that the researchers' relatively nonevaluative, noninterventionist stance toward the teachers was having the predicted effect of providing the teachers with the necessary support for making their own discoveries about their practice and their own decisions about whether and how their knowledge and instructional behaviors might change.

Most poignant to us all in these early months was the salutary effects on their morale that the teachers reported upon reading each other's journal writings and discovering that they all shared deeper frustrations, strains, and self-doubts about their teaching than they had ever realized or been able to reveal to each other before--and despite the fact that they had worked closely as a team and had been close personal friends for eight years. This realization helped to assure each one that she was not unique in experiencing these deeper vulnerablities and that sharing them was not as risky as each might have previously thought. We feel now that this episode also helped solidify their sense of trust in the researchers and their commitment to a project which was otherwise itself somewhat puzzling in its open-endedness and its lack of specific foci beyond what we were all in the process of defining jointly.

As a parallel development at this time, Navarro and Principal 1 were reporting that their conversations were having quite an important cathartic effect on the principal. She was finding herself able to share some of her own uncertainties about her new role, in ways that made those uncertainties more explicitly concrete and available to her for further reflection and deliberation. Navarro's nonjudgmental responses contributed to her becoming increasingly articulate about and self-confident in the decisions she was making to shape her role as a supportive instructional leader. Her participation in the meetings at which the teachers were sharing their insights and vulnerabilities provided her with critical insights about what would constitute supportive leadership from their point of view. And her sharing with the teachers her own experiences and reflections as occasioned by the project served to reassure them concretely that there was indeed empathetic support within the building for the kinds of risks they had already taken in being self-disclosing during our meetings and the kinds of risks they would be taking the following fall as they began to reorganize their modes of instruction. As we parted for the summer break, we realized that Principal 1's involvment was a most fortunate, if serendipitous, turn of events for the project, more than offsetting our frustrations at not being able in the short run to devote as much attention to the area of organizational change at the district level as we had originally hoped.

Confronting and Changing Established Teaching Practices (September-December 1985)

Upon the beginning of the new school year in early September 1985, the researchers resumed their classroom visits and their journal exchanges with the teachers, while also starting to videotape one- to two-hour sequences of activity in each teacher's room. At this juncture, quite unfortunate circumstances led to a change in the composition of teachers participating in the project: Teacher A had become seriously ill and was not able to resume her classroom duties for the 1985-86 school year. (Happily, she has returned to her classroom and to our project with the beginning of the current school year.) Principal 1 offered to approach a second-grade teacher in the building whom she thought might be interested in joining the project; Teacher D was indeed interested, and quickly became involved with our work at the whole-group discussion level and with Erickson and Raphael at the classroom team level. In October, Teacher D was appointed as principal in another building in the district, but continued to work with the project in ways similar to Principal 1 (she will be referred to as Teacher D with respect to her participation during September and early October, and as Principal 2 with respect to her subsequent activities.)

The first whole-group meetings in September were devoted to planning the various classroom activities and scheduling the whole-group meetings for the rest of the fall. Time was also spent on how we might best incorporate the video recordings into our activities and discussions. As the fall unfolded, Teacher B most especially found that viewing the videotapes of her classroom had an important effect on her understanding of her own teaching. She reported that the video record provided for her an even more compelling set of additional eyes on events outside her immediate purview than had been constituted by the observations and journal entries of her team members alone.

With the additional vantage points offered by both the researchers and the video record, she and Teachers C and D found themselves in the new school year already beginning to revise their thinking about such an obviously management and stress-producing phenomenon as the level of the children's noise while doing their seatwork as the teachers conducted small-group reading instruction. Later in the year the teachers were quite articulate in conveying their insight that perhaps their concern for the level of noise said more about them than it did about whether or not the children were engaged in productive academic work. The videotapes in particular made it possible for the teachers to see that, while they were preoccupied with their reading groups and distracted from that focus by the ebb and flow of noise, the other children in many cases were often quite productively engaged in their work, even when it was noisy--or even as evidenced by the noise, as a sign of enthusiastic engagement with subject matter.

But that level of insight did come later and did depend on other changes in their teaching that had yet to occur as the new year was beginning. In our late September and early October group meetings, we were finding that the researchers and practitioners were still operating from different perspectives with respect to the major foci of interest for our joint work. The teachers remained primarily concerned with how to manage the multiple non-academic and clerical demands and constraints on them as professionals working without adequate public recognition or personal self-esteem. The researchers continued to ask how these issues might be transformed, if not completely resolved, by beginning with a focus on subject matter instruction and the accompanying materials and experiences that would engage students' academic curiosities and interests.

Even as we continued to struggle with this dichotomy, much as we had the previous spring and with further progress on seeing the issues as in fact inextriably combined, and even as we found ourselves mutually reassured about our common commitments to providing quality learning experiences to all children and to working as well on these teachers' legitimate concerns about the conditions of their work life and their status as professionals, we also realized in late September that the teachers and principal had good reason to suspect the research team's commitment to the teachers' interests and concerns as primary in this project. As described in more detail elsewhere (Campbell, Raphael, & Zietlow, 1986), the research team's increasing reference to reading instruction and reading research in our first several group meetings in September struck the teachers as a clue to an answer they had apparently been seeking since the beginning of the project. Given their lack of familiarity and experience with the open-ended, even ambiguous approach to staff development and educational research that our project represented, they quite naturally wondered whether the researchers were really operating with a hidden agenda that might--or might not--be eventually revealed to them. The emphasis on reading appeared to them possibly to be the answer to the question of what the hidden agenda had been all along.

After one of the teachers directly asked one of the researchers about this, we were able to discuss this issue more directly. The researchers assured the teachers and principal that, although they did have strong interests in reading issues, they were nonetheless committed to following the teachers' lead in defining the foci of our work. The teachers and principals assured the researchers that they had developed sufficient trust in the research team to have realized there very well might not have been a hidden agenda in the first place.

Although this area of potential conflict and crisis was easily resolved, during this period there were other developments in the teachers' individual experiences at the classroom and team levels that did involve varying kinds of conflicts and/or misunderstandings, the resolutions of which were somewhat less straightforward--though also with rather dramatic impacts on the teachers' thinking and classroom practices. For Teacher D, a journal observation by one of the researchers that her treatment of the lower ability reading group might constitute a "public display of [their] incompetence" struck her initially as a severe challenge of her commitment to provide a safe, supportive learning environment for all children. Upon reflection, she realized that the researcher did not intend to impugn her motives or commitments. She decided to take a closer look at how she was in fact treating the children in the lower group. She eventually found herself reorganizing her reading groups heterogeneously with respect to ability and providing them with activities that enhanced cooperative learning and positive peer teaching, while minimizing the negative labelling effects of the designations "good reader," "slow reader," etc.

Teacher C also experienced a kind of confrontation with a member of her team that led to dramatic changes in her teaching. She remembers the researcher observing one day in early October that nothing "educational" was going on in her classroom. The researcher remembers responding with something of the sort to a question that Teacher C had asked her, but decidedly not with the intention to criticize her nor to pronounce such a global judgment about Teacher C's classroom. It appears that there was a legitimate misunderstanding associated with this exchange. In any case, Teacher C reported some months later that she found herself realizing that same evening that the remark had touched a deep nerve of doubt and concern that she had not fully addressed to herself recently--that is, the concern that perhaps there was some truth to the researcher's remark as she had interpreted it. The immediate result of this realization was that she began the very next day to reorganize her classroom to emphasize cooperative learning and to share teaching and management responsibilities with the children, primarily through developing a system of learning centers in which the children would encounter more intellectually challenging activities. She has continued to develop this approach into the current school year.

Teacher B seems not to have experienced any such dramatic conflicts or misunderstandings with the researcher members of her team. Rather, she has reported that through the course of the project she had been feeling increasingly uncomfortable with having fallen in recent years into a pattern of providing merely better-than-average teaching to her students, as opposed to challenging both them and herself to the fullest of their capacities. Early in September she was struck with how mindlessly simple a particular mathematics worksheet was for providing children with meaningful practice using the concept "one more than." This apparently led her to redouble efforts she had already begun to introduce her children to mathematical concepts with concrete, manipulable materials--a principle of pedagogy with which she was already quite familiar from her preservice course work and from subsequent inservice workshops on early childhood learning, but which she realized she had not been motivated to apply under the weight of other demands on her in the classroom.

Later in October, she also began to experiment with learning centers and with more creative writing tasks for the children not involved in small-group reading instruction. For her, these latter efforts followed from becoming more aware through observing videotapes of the disjunctions between her presumptions about the children's activities during seatwork and what the video record revealed that they were actually doing.

As these brief descriptions suggest (see Torres, Kirschner, & Curtis, 1986, for more details), the three teachers varied in the nature and extent to which inter- versus intrapersonal conflict and/or misunderstanding with members of the research staff affected their experiences of deepened insights and changed instructional practices. In all three cases, it should also be emphasized that these factors alone do not account for these teachers' individual developments. As they have reported to the researchers, multiple factors weigh into their own understandings of how and why they have changed in the ways they have--not the least of which include the time that they had during the first year to begin thinking about their teaching, the support that the researchers provided, and the gradually strengthening and occasionally well-tested sense of trust we had all been developing with each other.

During this phase, Navarro and Principal 1 continued their conversations about her role, and their participation in the whole group discussions about the teachers' changing perspectives and practices. Principal 1 increasingly saw and articulated the parallels between what the teachers were reporting about their changed conceptions and practices with respect to children and what she was defining and enacting with respect to her role relationships with the teachers in her building. She found her own frustrations with administrative accountability for student outcomes echoed by the teachers' similar sentiments.

The recurring themes of accountability and "100% responsibility" led both the teachers and Principal 1 to different definitions of their role relationships. Their joint experience of shared reflections about their practice, in a professionally supportive environment, helped these practitioners make more explicit for each other the kinds of leadership and material resources each needed to improve her own practice. For Principal 1, this meant seeing her efforts to have her own ceiling of possibilities as an instructional leader lifted as parallel to and supportive of the teachers' need to have their own ceilings raised, as the teachers themselves were seeing the further parallel of how their reflections about their practice were leading to ways in which the limits previously imposed on their students could also be lifted.

When Teacher D became Principal 2 in another school in November, she found that the insights she had gained from questioning old assumptions as a teacher participant in the project had a significant effect on how she began to define her new role as a principal. Just as she had sought new ways to unlock the potentials of all her students, she now set out to unlock the potential she knew existed in the teachers in her new school. During the remainder of the fall, she concentrated on identifying the expertise of each teacher in her building, as a prerequisite to facilitating their individual growth in a manner similar to how she was beginning to facilitate the individual growth of her students when she was promoted. (See Navarro, Berkey, & Minnick, 1986, for more details about the principals' roles and experiences in this project.)

Beginning to Address Audiences and the Issues of Organizational Change (December 1985-June 1986)

The developments and changes sketched for the teachers and principals in the previous section continued past the critical meetings of September and early October and through the end of the school year in June 1986. Correspondingly, our two main areas of activity (the classroom-based videotaping, journal exchanges, and informal conversations among team members; and the whole-group discussions) continued as occasions and mechanisms of support for further understanding how the teachers' conceptions of their practice were changing and for transforming those changes in perspective into specific changes in the instructional and social organization of classroom life.

A third major area of activity, the presentations of the practitioners' experiences to various audiences, developed as an outgrowth of our progress and our efforts to support continued change at the classroom level. In the first two phases of the project, we found ourselves focusing primarily, and almost exclusively, on the teachers' insights about and experiences within their classrooms. Although we still felt that support for these efforts, and possible organizational changes at the district and higher levels of our educational system, were crucial for the wider and long-term viability of our approach to staff development, we had nonetheless found it difficult to pursue this support, partly because of how deeply engaged we found ourselves becoming in the efforts of the teachers to examine and change their instruction, but also because of how relatively more elusive and diffuse were the implications and avenues for action beyond the immediacy of the practitioners' experiences.

Equally important was our decision early in the project that our work with the teachers would be better facilitated by identifying established units and audiences within the district rather than by creating the more artifical district Planning-Implementation Council (consisting of school board members, administrators, union officials, and parents) that we had originally proposed. That Principal 1 became so actively involved in the work with the teachers was yet another important factor; her participation was itself a naturally emerging way for the teachers to connect their efforts to a context, the school building, which was outside their immediate frame of reference, but not so far away as to distract them from the focus of their reflections on instructional practice.

Nevertheless, we remained mindful of the need to follow through on our original goal of having the teachers' visions and experiences conveyed to people beyond our immediate project participants and in positions of influence regarding efforts to improve teaching and staff development. Accordingly, and consistent with our commitment to providing a supportive, relatively low-risk environment for the teachers' explorations of new ways of thinking and acting, we decided in November 1985 to use ourselves as the first formal and least threatening audience to whom the teachers could practice making presentations of what they were experiencing and learning. As the previous phase of activity was coming to its conclusion in late November and early December, we began to include in our whole-group meetings time for discussing what each teacher might present and how her story could be illustrated with the materials we had been gathering, including samples of student work, journal entries, and video recordings. We also decided that it would be crucial for Principal 1 to present her own experiences and reflections as the project participant who provided the critical link between the teachers and the district.

The presentations were made at our last whole-group meeting in December. Teacher B described her experience with the inadequate worksheet in teaching the concept of "one more than" and how that led her to focus her reflections on more engaging and intellectually challenging experiences for children in mathematics. Teacher C shared her experiences more broadly, covering the evolution of her thinking about "100% responsibility" over the course of the project, including her recent explorations with cooperative learning centers. Principal 1 described how she had come to shape her identity as an instructional leader in ways that paralleled the teachers' efforts to open up the horizons of learning possibilities for their children. Teacher D had been too preoccupied recently in her new role as a principal to make her own presentation, and so she participated with the researchers as a member of the audience.

We were all quite pleased with this first effort of the teachers and principal to articulate their stories of struggle and change and so we planned another presentation for early February. To ourselves as the audience we added two IRT senior researchers and two IRT teacher collaborators, people we knew to be sympathetic to our approach but who were sufficiently unknown to the teachers and principal and removed from their immediate classroom and building frames of reference as to provide for the event a more formal character and a more challenging task of articulation and persuasion. On this occasion, Teachers B and C and Principal 1 refined and elaborated the presentations they had made in December; Principal 2 told of her encounter as Teacher D with one of the researchers over the "public display of incompetence" remark.

Our IRT guests were uniformly impressed with the presentations, though not without some skepticism about whether the overwhelmingly positive and optimistic tone of each story was an accurate reflection of all that the teachers and principals had experienced. Could the changes in thinking and practice have come about as easily as they had suggested, and could the improvements in the quality of learning experiences for children have been accomplished in ways that lightened the teachers' workloads and stress levels, as they were seemingly claiming?

These questions engaged our attention in our group discussions after the February presentations; they reinforced the tendency we had already noticed for our discussions since October to focus increasingly on what features of the project's activities and processes accounted for the changes the teachers and principal experienced in the fall of 1985. In addition, as the time for our April American Educational Research Association symposium on the project was rapidly approaching, we were further motivated to examine what had happened since we began, when, how, and why. In particular, during February and March we found ourselves more able to discuss the role of conflict, struggle, misunderstanding, and crisis in how the project unfolded and in how our conceptions about and practices in instruction were changing. These discussions eventually led us to realize the importance of acknowledging and describing the variations and diversity in how the various features of our project activities account for the experiences of deepened insights and changed instructional practices for each of the project participants.

Since our last progress report (March 31, 1986), the teachers and principals have participated in four additional presentations about their experiences in the project. All five of the practitioner participants accompanied the IRT researchers to the annual AERA meeting in April. Although the researchers made the formal paper presentations at the symposium on the project, the teachers and principals participated actively during the discussion period. (Indeed, most of the questions from the audience were directed to them, and it did not fail to pass our attention that there was considerable irony, at best, in the stories of a practitioner-centered approach to staff development being told by the researchers rather than the practitioners themselves.)

Early in May, one of the project coordinators (Campbell) both principals, and Teacher B made a brief presentation to the district superintendent of what the project had accomplished to date and of what further support from the district we hoped to have in order to continue our work and to include additional teachers in our activities. At the conclusion of this meeting, the superintendent reiterated his continued support for our work and conveyed his admiration for how well the principals and

Teacher B had articulated their experiences and their visions of the value of this staff development approach for other teachers.

The following week the teachers and principals made formal presentations to the other teachers in the building, as part of a regularly scheduled meeting for staff develpment purposes. On this occasion each presentation was much more forthright and explicit about the difficulties each practitioner had experienced in coming to the changes in insight and practice that were otherwise being presented quite positively and eloquently as the value of their participation in the project. The researchers were quite struck by the apparently spell-binding effect that the presentations had on the other teachers, as evidenced by their rapt attention during the presentations, their incisive questions, and the fact that no one seemed to notice or to mind when the event went 30 minutes past the time that it had been scheduled to conclude. Principal 1 later reported that several of the teachers had been quite moved by the presentations and especially by the ways their own experiences resonated with the presenters' sharing of doubts, fears, and vulnerabilities as necessary parts of their stories and of the processes of positive change they had experienced.

The fourth presentation during the Spring of 1986 was made during a meeting of the project participants and Dean Judith Lanier and Associate Dean Diana Pullin of the MSU College of Education. The purpose of this meeting was to explore ways in which the approach of the project might articulate with plans being formulated by Dean Lanier and her colleagues to follow up on the recommendations of the Holmes Group. Deans Lanier and Pullin later reported to us and to others how impressed they were in general with the ways in which the teachers and principals had related their particular experiences in the project to larger issues of concern to teachers and teacher educators. During the meeting itself, we explored specific ways in which what we had been doing exemplified several aspects of the envisioned establishment of professional development schools as sites for closer collaborations between articulate, self-reflective, and innovative practitioners and university-based teacher educators and educational researchers.

Assessment of Accomplishments and Next Steps

What then have we learned from this project, and where might it lead? With the end of the 1985-86 school year in June, we came to the end of our originally scheduled involvement with the teachers and principals. Our collective sense of where we were at that point was that we had made remarkable progress on a number of fronts during our year and a half of working together.

As evidenced by their own reports and by the observations of the researchers, the teachers and principals have experienced significant change in a number of areas. In the realm of their thinking about their practice, they have been able to reflect more systematically on their implicit assumptions about their teaching, and in the process they have altered several of the central views that guided them at the outset of their participation. Concerning their roles as teachers, they now do not take for granted that they have all the responsibility for the children's education;

related to this is the increased value to them of having the children assume some of the responsibilities for both the content and the management of their own learning. The teachers realize now that in the past some of their assumptions about children's cognitive abilities and socioemotional needs operated to limit their expectations of what the children could accomplish in their classrooms. They talk about their revised view as a matter of raising their ceiling of expectations for the children--one result of which is that they have noticed a much more positive attitude of their students toward learning activities, accompanied by their own lessened concern for noise levels and by a corresponding lessening of stress in their own reactions to their jobs. At a more philosophical level, we have all refined our views of the management/curriculum dichotomy, such that we jointly are able to communicate more effectively and concretely about how the insight of the intertwining of these tasks might play out in their daily decisions about organizing meaningful learning opportunities for children. With respect to differences in children's abilities, especially in reading, the teachers lately have been talking about the dangers of stereotyping and labeling.

With respect to their actual classroom practices, the teachers have made important strides in how they teach mathematics and writing and in how they organize the activities of the children who are not working with them in small-group reading instruction at any given time in the morning. Where before the children's writing assignmments each morning consisted of copying teacher-generated texts from the board, now the teachers either assign a topic or have the children select one of their own, with the teacher then providing and eliciting from the students key words and phrases from which the students draw to produce their own texts. Where before each child would work on seatwork activities more or less independently when not in his or her reading group, now they are organized into cooperative learning groups that move from learning center to learning center to engage in more meaningful activities and to participate in the previously teacher-exclusive tasks of monitoring academic progress and keeping order.

Principal 1, throughout the project, and more recently Principal 2 as well, have experienced parallel developments in their own thinking and practices. They see their role as instructional leaders as involving the tasks of identifying the strengths and needs of their teachers and of then providing the support and resources for the teachers to make their own decisions about what to do within their own classrooms, as well as how to relate to each other as colleagues and how best to use the time allowed to them for staff development activities. The principals see their role as facilitators of the teachers' development, a stance that leads them to see their role as involving a link with district-level personnel. In this project, that link has been crucial to our accomplishments; among other things it has involved the principals' willingness and effectiveness in articulating the teachers' need for the kind of opportunities for reflection that our project provides.

With respect to our goal of addressing issues of organizational support and change necessary for teachers to engage in self-directed staff development and to have their voices heard in current discussions about reform in teaching and teacher education, we feel we have made a modest but significant beginning in this project. Though we are concerned as the project concludes that we were not able to do more at the district level, we are encouraged by having had the opportunity for the teachers and principals to present their experiences to a diverse set of audiences. We have been especially pleased about how the presentations became progressively more concrete in the examples provided as evidence for more general claims about the benefits of this approach to staff development and how the presentations also became more balanced in covering the difficulties, conflicts, pains, and struggles involved in effecting changes in perspective and practice.

Having the principals involved in these presentations, as well as more generally in the project's various activities, is again a major unanticipated but quite significant way in which we were able to prevent our work from focusing exclusively on teaching and learning issues within the classroom, cut off from the larger contexts that affect both instruction and teachers' sense of themselves as respected professionals.

How do we account for all of this? In our whole-group meetings during the past year, we devoted considerable attention to this question, and the researchers are continuing to explore this in developing their case studies of each participant. Our analyses have focused on two major levels of factors. On the one hand, we have focused on the specific activities of our work with the teachers at the classroom level, that is, the classroom visits and informal discussions, the exchange of reflective journals, and the video recordings. Here we find that the teachers vary in which of these activities seem to have been most important.

At a more global level, we have found ourselves continuing to come back to the importance of time for the personal reflections and group discussions that the teachers have found so valuable in their efforts to examine and improve their classroom instruction. Conflict, whether intra- or interpersonal, seems to have been crucial. With respect to the former, we see the importance of these teachers' readiness to engage in this kind of potentially unsettling project--which raises the larger issue of whether any of this could have happened with teachers not having a predisposition to engage in open-ended reflection and to taking the risk of seeing and conducting instruction in new ways. With respect to interpersonal conflict, the theme of trust continually surfaces, as a prerequisite for weathering difficult times. Trust was gradually developed in the relationships between the practitioners and researchers. We feel trust was facilitated by the researchers' commitment to having the teachers define the main focus of our activity and by our joint efforts to avoid premature closure on both the topics and procedures of our work. That the teachers themselves already had a well-established relationship of trust and mutual respect among themselves is also an important factor underlying our accomplishments.

As we conclude this phase of our work, we find that we have not yet fully answered the questions of how and why the changes we have observed have come about. Two related matters bear noting here. First, although the researchers obviously have a stake in presenting the case for their perspective and participation as crucial to the accomplishments that we can document, they have also been struck repeatedly by indications that their main contribution has been to provide the opportunities and supportive contexts and resources for reflection and change--a certain amount of serendipity, the pre-existing abilities and commitments of the teacher and the principals, and the strong support of the district account for our results as much as anything specific that the IRT staff provided.

This is related to the second point: Although in this final report and in our other writings about the project there is a natural tendency to talk about what has changed in the teachers' conceptions about and practices in their classrooms and in their presentations to various audiences, it is important to emphasize that for these teachers, at least (and our assumption is that it is the case for more teachers than is generally acknowledged), there was already sufficient knowledge about teaching and skill in its enactment with children, drawn from previous experience and other professional development opportunities, to build on when given the time and support for critical self-reflection. That they have "changed," then, does not mean that they were basically beginning from scratch when they agreed to work with this project.

Whether this claim about the importance of time and support as the most important conditions for positive, self-directed growth does in fact apply generally to teachers remains an important, but unanswered question from our research. We do suspect that the practitioners with whom we have been working are unusually competent and committed to further improvements as professionals, but just how unique they are we cannot tell. This does, of course, raise the issue of to whom and how our approach might be extended. As the project formally ends under IRT auspices, we are beginning to extend the work within the district in ways that might further help us address this issue.

Consistent with our approach to date, we are making these extensions gradually, partly in principle but also in light of limitations in our resources. The principle involves our commitment to having the work evolve as naturalistically as possible, with the role of the researchers being primarily to provide support and document the process, rather than to manipulate the conditions that would allow for a more directed test of competing factors that might account for changes and suggest dimensions and avenues of applicability to a wider population of practitioners, working under diverse circumstances. As it happens, Principal 2 had identified one of her teachers (Teacher E) as doing self-directed curricular development work in reading instruction; she arranged for this teacher to meet with Teachers B and C last spring. This fall, as we have resumed our work, Teacher E has already had a very productive meeting with Teachers A, B, and C, at which she explained what she was doing with reading in her classroom, and during which she heard about how our teachers had rearranged their classrooms for cooperative learning. We are also interested in following how Teachers B and C help to reintegrate Teacher A into the project.

Concerning our limited resources, the IRT researchers are uncertain about where they might seek funding to continue this combined work in the conduct of and research about teacher-centered development (though we have been assured of the district's continued provision of release time for participating teachers). And, only three of the original seven researchers remain available to continue this work in this district (though both Erickson and Torres hope to begin similar efforts in Philadelphia and New York where they now live). These limitations, however, also provide certain advantages that relate to the principles upon which we have been operating. Although occasioned by necessity, the smaller number of researchers does mean that the research presence per se has changed--thus providing a natural opportunity to investigate the extent to which the researchers' presence and perspective are critical factors behind the kinds of accomplishments we have noted to date. Perhaps more importantly, we now have the opportunity to examine whether and how the teachers with whom we have been working take on the role of relatively nonjudgmental, nonintervening observers in other teachers' classrooms. We will also be able to see to what extent the teachers are willing and able to take on the documenting tasks that have up to now been performed primarily by the researchers.

In any case, as we conclude this period of our work, and this report on its accomplishments, it is important to emphasize that we have come to a point where we can document in more detail the process by which a small number of teachers and principals evolved a micro-community of discourse with university researchers, and the ways in which their thinking and their practices underwent supportive but critical scrutiny, leading to revisions and refinements in their normal modes of action as professionals. We have seen these practitioners gradually find their voice and express their ideas and experiences to increasingly diverse and removed audiences. And although we have found the organizational change aspects of our work less easily attended to, we maintain our commitment to examining the larger contexts that both enhance and constrain teachers' actions on their own behalf--and we offer these teachers' and principals' experiences in this project as an important component that must not be ignored as discussions proceed in our society about how the education of our children and our teachers might best be improved.

Dissemination

The following are the titles of the presentations made at the symposium "Teacher Development and Organizational Change: A Case Study" at the annual AERA meeting in San Francisco on April 19, 1986:

"Overview and Major Themes of a Project Combining Research with Staff Develpment" (Frederick Erickson, Margaret Brown, and Judith Hetherington)

"The Teacher as Active Agent in Research and Staff Development" (Maria Torres, Becky Kirschner, and Teresa Curtis)

"Perspective Differences and Role Conflicts in Research-Centered Staff Development" (Douglas Campbell, Lev Raphael, and Kathryn Zietlow)

"The Art of Becoming an Instructional Leader" (Richard Navarro, Ramona Berkey, and Francine Minnick)

We have also submitted proposals to AERA for two symposia we wish to conduct at the annual meeting to be held in April 1987 in Washington, D.C. One symposium, "Teacher Development and Organizational Change: A Case Study of Researcher/Practitioner Collaboration," will include the following papers, as further case study accounts of the work of this project:

"Teacher-Initiated Instructional Change in the Classroom" (Douglas Campbell, Teresa Curtis, Kathryn Zietlow, and Judith Hetherington)

"Teacher-Initiated Staff Development and Professional Growth" (Becky Kirschner, Kathryn Zietlow, Judith Hetherington, and Teresa Curtis)

"Defining Roles for Principals as Facilitators of Teacher Development and Organizational Change" (Richard Navarro, Ramona Berkey, and Francine Minnick)

The second proposed symposium is titled "Teacher/Researcher Collaboration in Research on Teaching: Models of Collaboration"; it will involve an exchange of ideas among participants from our project and from three or four other projects around the country.

The following is a published article that is based on our project:

Erickson, F. (1986). Tasks in times: Objects of study in a natural history of teaching. In K.K. Zumwalt (Ed.), Improving teaching (1986 ASCD yearbook, pp. 133-147). Alexandria, VA: Association for Supervision and Curriculum Development.

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Campbell, D., Raphael, L., & Zietlow, K. (1986, April). Perspective differences and role conflicts in research-centered staff development. In M. Brown (Chair), Teacher development and organizational change. Symposium presented at the annual meeting of the American Educational Research Association, San Francisco.

Navarro, R., Berkey, R., & Minnick, F. (1986, April). The art of becoming an instructional leader. In M. Brown (Chair), Teacher development and organizational change. Symposium presented at the annual meeting of the American Educational Research Association, San Francisco.

Torres, M., Kirschner, B., & Curtis, T. (1986, April). The teacher as active agent in research and staff development. In M. Brown (Chair), Teacher development and organizational change. Symposium presented at the annual meeting of the American Educational Research Association, San Francisco.

COMMUNICATION, DISSEMINATION, AND RESEARCH TRAINING

COMMUNICATION, DISSEMINATION, AND RESEARCH TRAINING

The Communication and Dissemination Unit supports, supplements, and coordinates the IRT's work in two important areas: (a) collection, synthesis, and analysis of research on teaching and (b) dissemination of research findings, methodological approaches, and analyses of research on teaching to those concerned about educational improvement. These two closely linked areas are the responsibility of all IRT staff, and all IRT staff take part in the training of future researchers.

Synthesis and Analysis of Research

Since its inception, part of the IRT's mission has been to supplement and integrate the work of its individual research projects with research analyses and syntheses activities. These activities include discussion of how IRT research findings fit together with one another and with those of other investigators at other institutions.

IRT Synthesis and Analysis Monographs

The IRT has put out a number of synthesis and analysis papers in our Monograph Series, many of which have appeared as journal articles, chapters in books, or books. A book published this fall analyzes the impact of reforms advocated by criticism of current education:

> Sedlak, M.W., Pullin, D., Wheeler, C., & Cusick, P. (1986). Classroom perspectives on school reform. New York: Teachers College Press.

Earlier this year, the third edition of the Handbook for Research on Teaching featured six chapters based on IRT research and synthesis work (the Research Series number or Occasional Paper number appears in parentheses):

Brophy, J., & Good, T. Teacher behavior and student achievement (O.P. 83)

Clark, C., & Peterson, P. Teachers' thought processes (O.P. 72)

Erickson, F. Qualitative methods in research on teaching (O.P. 81).

Feiman-Nemser, & Floden, R. The cultures of teaching (O.P. 74)

Good, T., & Brophy, J. School effects (O.P. 77)

Lanier, J., with Little, J. Research on teacher education (O.P. 80).

Phi Delta Kappa's Center for Evaluation Development and Research publishes a Hot Topics Series to provide educators with collections of the "best research and practice" available on topics of wide current interest. Two works from the IRT Monograph Series were selected, on the basis of information gathered from a poll of leading educational organizations, to be included in Volume 11, Effective Classroom Management (1986):

Brophy, J. Classroom organization and management (O.P. 54).

Clark, C., & Yinger, R. The hidden world of reading: Implications for teacher planning (R.S. 77).

An earlier synthesis and analysis article by Jere Brophy received AERA's Palmer O. Johnson Award for the best review article published in an AERA-sponsored journal:

Brophy, J.E. (1981). Teacher praise: A functional analysis. Review of Educational Research, 51, 5-32 (O.P. 28).

A partial listing of synthesis and analysis monographs from various projects follows:

Classroom Strategy Research

Brophy, J.E. (1983). Conceptualizing student motivation (O.P. 70).

Brophy, J.E., & Hannon, G. (1984). The future of microcomputers in the classroom (O.P. 78).

Brophy, J.E., & Putnam, J.G. (1979). Classroom management in the elementary grades. In D. Duke (Ed.), Classroom management, (78th yearbook of the National Society for the Study of Education, Part III) (R.S. 32).

Content Determinants

Schwille, J., Porter, A., Belli, G., Floden, R., Freeman, D., Knappen, L., Kuhs, T., & Schmidt, W. (1983). Teachers as policy brokers in the content of elementary school mathematics. In L. Shulman & G. Sykes (Eds.), Handbook of teaching and policy (R.S. 113).

Effective Schools

Edmonds, R.R. (1983). An overview of school improvement programs. Educational Leadership, 40(3), 4-11 (O.P. 67).

Science Teaching

Anderson, C.W., & Smith, E.L. (forthcoming). Teaching science. In V. Koehler (Ed.), The educator's handbook: A research perspective.

Teacher Explanation Project

Duffy, G. (1981). Teacher effectiveness: Implications for reading education. In M. Kamil (Ed.), Direction in reading: Research and instruction (30th yearbook of the National Reading Conference) (O.P. 45).

Duffy, G. (1982). Fighting off the alligators: Implications of research for classroom teachers. Journal of Reading Behavior, 14, 357-374.

Duffy, G., & Ball, D. (1986). Instructional decision making and reading teacher effectiveness. In J. Hoffman (Ed.), Effective teaching of reading: Research and practice. International Reading Association.

Teacher Planning

Clark, C.M. (1983). Research on teaching planning: An inventory of the knowledge base (O.P. 66).

Other

Clark, C.M. (1979). Five faces of research on teaching. Educational Leadership, 37, 29-32 (O.P. 24).

The Invisible College

One way in which the IRT promotes synthesis and critique of research information is by coordinating the Invisible College for Research on Teaching, an informal network of scholars conducting research in the field. The Invisible College had its origins in the NIE-sponsored National Conference on Studies in Teaching held in Washington, D.C., in 1974 and smaller conferences held in San Diego in 1975 and in Austin in 1976 for investigators funded by NIE to conduct research on teaching (primarily process-product research).

At the time, research on teaching was just beginning to coalesce as a coherent and continuing focal area of scientific investigation and opportunities for personal contact and professional interaction were especially valuable. These meetings brought together many of the leaders of the field for what turned out to be productive and highly valued opportunities to share state-of-the-art knowledge and argue research priorities and strategies.

These meetings provided opportunities not available through existing mechanisms such as the annual AERA meetings. The group was smaller and more focused, there was more opportunity for informal social contact in between scheduled meetings, and the meetings themselves emphasized interactive discussion of state-of-the-art issues and research in progress rather than reports of completed research presented by a single speaker addressing a largely passive audience.

IRT connection. To sustain the opportunity for researchers on teaching to meet informally, Michigan State University's original Institute for Research on Teaching proposal provided the establishment and coordination of an informal organization of researchers on teaching. Borrowing an established sociological term for informal groups of scholars who share few if any formal organizational ties but communicate with one another because of shared scholarly interests, the IRT proposal referred to the envisioned organization as the "Invisible College" for research on teaching. Since 1976 when the IRT was awarded to MSU, the Invisible College has been a continuing part of the IRT's contributions to the field and has been coordinated by one of the IRT co-directors (initially Lee Shulman, and more recently Jere Brophy).

The format of meetings. Under IRT leadership, the Invisible College has met each year for a two-day period immediately prior to AERA and in or near the AERA convention city. The emphasis on informal discussion continued, with membership open to anyone conducting research or scholarly activity focused on teaching. The organization grew and flourished in ways that paralleled the development of the field of research on teaching itself. Process-product researchers interested in linking teacher behavior to student achievement gain were joined by other researchers employing a variety of methods to address a variety of topics. By 1985 more than 300 individuals were on the mailing list and 125-150 were attending the annual meetings.

The continued popularity and growth of the Invisible College testifies to its functional usefulness to the members. The organization has been deliberately kept informal. There are no elective offices, honors or awards, or other extrinsic inducements to participation. The organization functions as an informal mechanism for (a) inducting new scholars into the field by bringing them into contact with established scholars; (b) sustaining informal communication among established scholars; and (c) providing a forum for activities such as discussing the apparent implications of emerging findings, assessing current progress and logical next steps in scholarly research, and debating important conceptual and methodological issues.

Shift to larger audience. Although the growth and diversity of the Invisible College were gratifying, they introduced problems that eventually led to a reconstitution of the organization in 1985-1986. As meetings became larger, there was a shift from informal roundtable discussion with participation by most of the group toward presentations made by a small group of presenters to a larger and mostly passive audience. Concurrent sessions were scheduled, but, with attendance at 125-150, most sessions were too large for spontaneous interactive group discussion. The organization also began to attract members who were primarily consumers of research and scholarly work on teaching, not researchers themselves. As a result, many sessions drifted into generalized philosophical discussions of implications and away from sustained attention to the research itself.

Reorganization plan. In 1985 a committee appointed by Brophy unanimously called for reaffirmation of the original purpose of the Invisible College and reconstitution of the membership to limit it to individuals conducting research or scholarly activities on teaching. A two-pronged plan for accomplishing this was developed and then implemented between the 1985 and the 1986 meetings.

First, the organization was disbanded and a new organization formed that required formal application for membership indicating credentials and interests in research or scholarship on the topic of teaching (including teacher education). Graduate students and scholars just entering the field need not have accumulated a record of publications, but must show training and interests to prepare them to conduct research on teaching. Membership in the new Invisible College is approximately 150, half the organization's size in 1985.

Second, systematic efforts were made to resocialize the members to sessions devoted to discussion and debate of state-of-the-art issues in the field. For programs, an emphasis was placed on highly specific issues concerning the conceptualization, design, conduct, and interpretation of research on particular scholarly questions.

Meetings of the new organization. This year's meetings were held April 14 and 15, 1986, at the Meridien Hotel in San Francisco. Members agreed that emphasis on spontaneous group discussion of state-of-the-art issues in the field of research on teaching had been reestablished, thus fulfilling the primary purposes of the meetings and avoiding unnecessary overlap with the paper sessions and symposia presented later during the AERA meetings. Consequently, the policies followed in developing last year's Invisible College meetings will also be used in developing future meetings. Next year's meetings will be held on April 18 and 19, 1987, in Washington, D.C.

Working Directly With Teachers and Other Researchers

In this section we identify activities engaged in by IRT staff over the past 10 years. These activities include inservice workshops, paper presentations, panels, symposia, and keynote speeches given by IRT staff members based on IRT research. Approximate numbers are provided. Inclusion of the 1976-1981 totals allows one to gauge the most recent 5 years of IRT productivity relative to the previous 5 years.

Type of Activity	1976-81	1981-86
Speeches, symposia and paper presentations	302	556
Inservice workshops	71	67
Consultation assistance	40	50
Other (panels, colloquia)	25	99
Total	438	772

Audience	N	N
Teachers and school administrators	19,729	27,907
Educational researchers	7,513	18,084
Teacher educators	4,840	15,977
Other (policymakers)	2,268	3,227
Total	34,350	65,195

The above data summarizing IRT activity can be looked at in various ways (see tables in Appendix). For example:

. . . Forty-three percent of all IRT dissemination activity in 1981-1986 was aimed at public school teachers and administrators, an impressive statistic for a research organization.

. . . Dissemination activity has increased 73% in the past 5 years compared to the first 5 years, in large part because IRT research results have been increasing at a dramatic rate as research programs mature. The audience has almost doubled from 34,000 to 65,000.

. . . In the 10 years of its existence, staff members at the Institute for Research on Teaching have presented research results to nearly 100,000 teachers, administrators, educational researchers, and teacher educators.

. . . In the state of Michigan alone, IRT researchers reached over 20,000 teachers and administrators in school districts and state organizations from 1981-1986, a tenfold increase over 1976-1981.

In addition to making presentations of their own work, faculty at the Institute also provide research leadership through their involvement in the journal editorial process. IRT researchers currently serve on the editorial boards of over 20 different journals.

Assistance to Teachers

Many teachers and administrators have been indirectly influenced by IRT staff through formal dissemination efforts. The American Federation of Teachers, for example, conducts a national inservice training effort that draws heavily on IRT research findings in making recommendations for effective teaching practice. The Middle Cities Association, a consortium of 20 urban school districts in Michigan, has used IRT research in a two- to three-year professional development effort involving 200 elementary school principals (funded by the Kellogg Foundation and the Fund for the Improvement of Postsecondary Education). School improvement efforts underway at a number of sites nationwide (including Norfolk, Virginia; Jackson, Mississippi; and Spencerport, New York) are based in part on IRT school and teacher effectiveness research.

Local teachers have learned to be more analytic about using research to inform practice through participation in IRT's Conversations About Teaching group. In May 1984, a group of experienced teachers said they wanted opportunities both to explore issues in education (as well as issues in their own lives as teachers) and to heighten their own awareness of what they know as experienced teachers and of how they learn as professionals. They joined an existing IRT discussion group (the Teacher Collaborator

Forum) for monthly conversations beginning in October 1984. The group, including the IRT teacher collaborators, several researchers and teacher education doctoral students, and about 20 teachers from surrounding school districts has focused on practical uses of research.

Teachers Defining Enduring Problems of Practice

Consistent with the IRT's continuing commitment to involvement of practitioners in all aspects of the ongoing research program, the Teachers Defining Enduring Problems of Practice Project brought together a group of public school teachers and teacher educators to identify information and insights good teachers need in order to do their work better. The main purpose of the activity was to explore, with experienced, good teachers, two major questions: (a) What do experienced teachers need to know more about in order to become more effective teachers? and (b) What are the situational factors in schools that contribute to or hinder their professional growth and their ability to teach effectively?

Goals. The activity was seen as a logical extension of efforts 10 years earlier to define the enduring problems of practice. In the first year of the IRT's existence, Co-director Judy Lanier met regularly with the first IRT teacher collaborators and seven elementary school teachers to identify and define the issues and circumstances that were for them the "enduring problems." Now, after 10 years, and a knowledge explosion due to research on teaching, have these problems truly endured, or have they been replaced as the principal concerns of teachers? Do elementary and secondary teachers identify the same set of problems? Do those problems present themselves with equal urgency in classrooms in different settings, with different populations, in all grades and subjects?

Process. For the discussions, 7 teachers, together with 4 IRT teacher collaborators, were selected from among more than 80 nominated as "good teachers who are thoughtful and articulate about their work and interested in discussing problems of teaching." Care was taken in the selection process to ensure a broad cross-section of Michigan public school settings, elementary and secondary grade levels, and subject matter interest and expertise, but there was no effort to secure a representative sample of teachers. The outcome was not intended to be either a compilation of the views of diverse individuals, nor a survey of the thinking of a representative sample of teachers; rather, it was to be a set of critical issues, defined through a process of debate and analysis. The 13 teachers were joined in their deliberations by 2 IRT senior researchers and a Michigan State University teacher educator.

Over the course of the six-month period beginning in August 1985, the group engaged in intensive discussions to identify and define both (a) what more they needed to know in order to improve their practice and (b) what factors in schools contribute to or hinder their professional growth. In successive sessions, the group defined, refined, categorized, and elaborated their concerns. These experienced, good teachers talked with passion and eloquence about what additional knowledge they needed about subject matter and the teaching of it, about students, about the relationship of the broad goals and functions of schooling to their classroom practice, and about their own professional growth and the characteristics of their workplace that foster or inhibit their efforts to improve their practice.

Perspectives on students. Since the central task of teaching requires teachers to help all students learn while working with them in groups, teachers look at their students from a variety of perspectives. To experienced teachers, students are simultaneously learners, individuals, and members of a group (or groups). The theme of student diversity cuts across these perspectives, compelling teachers to observe and deal with similarities and differences between and among their students. Each of these perspectives implies a knowledge base and a set of considerations in planning for and delivering instruction. As the group defined their knowledge base, they described in detail not only the richness of their considerations, but also the kinds of information and knowledge they felt they lacked--knowledge that would allow them to teach more effectively.

Subject matter. Helping diverse students learn requires a quality of subject matter knowledge that would free the teacher to focus on students' sense making. At all grade levels, the teachers insisted they truly learned their subjects only by teaching them--but teachers in all grades still felt gaps in their subject matter knowledge. The group did not attempt to define the basic subject matter knowledge teachers need, but in analyzing occasions when they needed to draw on a deeper level of subject matter knowledge, they outlined categories of teacher decisions in which subject matter knowledge plays an important part.

Multiple goals of schooling. Teachers expressed strong concerns about their ability to provide quality education in an equitable fashion to all children, in the face of various outside interferences on their autonomy in the classroom and despite the variety of non-academic functions they are expected to perform. From their experiences, the group defined classroom implications of social and political pressures from federal and state mandates, from various constituencies' views of what should and should not be taught, from budgetary constraints, and from test-driven accountability efforts. They analyzed the multiple nonacademic tasks and functions that compete with academic instruction for classroom time and attention, such as monitoring students' health needs and vulnerabilities to abuse, providing informal counseling, and performing various record-keeping tasks as required by building, district, and state. And they debated issues of equity in the classroom given the larger patterns of educational and societal inequity.

Teachers' professional growth and classroom life. Experienced teachers are keenly aware of their own needs for personal and professional growth, and of the situational factors in schools that inhibit or promote their development. The group categorized and defined factors in their workplace and worklife that have important ramifications for improvement of their practice. These include organizational factors such as the physical environment, labor contracts, time allocation in schools; climate factors such as personal and professional power/status/roles of teachers, institutional norms and support for growth; and personal qualities such as self-motivation and commitment. Drawing on their own experiences, the group related each of these factors directly to their own efforts to improve their practice; they suggested that a better understanding of these relationships would lead to the enhancement of teaching and learning in all our schools.

Conclusions. The goals, the processes, and the outcomes of this activity have implications for researchers. First, experienced teachers and researchers share concerns about students, subject matter, and teacher decision making in the face of multiple and conflicting goals of schooling. Research on teaching should focus on these areas.

The activity also highlighted differences in the language of practitioners and researchers, in the priorities the two groups assigned to various issues, and in the relevance they attributed to effective teaching of structural and situational factors in schools. Involving practitioners in determining the directions of research facilitates the likely impact on practice of that research.

Finally, the activity can be analyzed as a prototypical intervention with several of the characteristics experienced teachers identified as necessary for the enhancement of their practice and promotion of their professional growth. The power of the activity is revealed in the determination of the group to continue after its task has been completed.

Colloquia

During the academic year colloquia are held almost every week at the IRT. Colloquia serve a variety of purposes: staff make presentations of their work; visitors give updates of their empirical findings and try out new conceptions for understanding teaching; visiting scholars who are senior researchers of national status (selected by interns and training coordinators) make formal presentations. A great deal of collegiality among researchers and research projects arises from these colloquia, which contribute greatly to the IRT's research synthesis and analysis activities.

From 1976-1986, nearly 225 colloquia were held at which IRT staff members and visiting scholars presented their work. The IRT has conducted a number of thematic colloquium series beginning in Spring 1979 with a four-part series on research methods and their relation to teacher education. In 1981-1982 a two-term series on reading comprehension instruction was conducted in collaboration with the Center for the Study of Reading at the University of Illinois. These were videotaped and used in graduate courses at both institutions. Written versions of the talks were published in the Longman's series.

A series of honors colloquia started in Winter 1984, for winners of a spacial MSU scholarship for undergraduates who major in science teaching. The course, for which these winners received credit, was open to the general public. In Winter 1984 the topic was "Problems and Possibilities of Science and Mathematics Education" and speakers included IRT researchers and other MSU faculty. In Winter 1985 the course was "Students and Their Teachers: Understanding What and How Students Learn in Schools." In Winter 1986 the course was entitled "Learning to Teach: Understanding Preservice and Inservice Education."

Influence on Teacher Education

A close, collaborative relationship has been established between the IRT and MSU's College of Education, a relationship that is partly structural in nature. IRT faculty are assigned part time (usually half time) to their research projects. As part of the remainder of their assignment, most IRT faculty teach in one (or more) of the college's teacher education programs. Instructional activity of this sort links research and practice and ensures that prospective and returning teachers are exposed to the most current educational research. Michigan State's model teacher education programs continue to enjoy national visibility, with teacher educators from other colleges across the nation and world visiting the College and IRT regularly to learn about these efforts. Many inservice teachers take graduate classes from IRT researchers and thus benefit from the most up-to-date information that research on teaching has to offer. Other teachers learn about IRT and other research on teaching through inservice workshops conducted by IRT staff.

In addition to these powerful but informal links to teacher educators, a monthly seminar involving faculty members from other colleges of education throughout the state is conducted to consider the implications of IRT research for teacher education. At the national level, several IRT staff members have played a key role in the Holmes Group Consortium which has issued a report (Tomorrow's Teachers) to reform teacher education programs across the nation. Consisting of deans and faculty members from the country's leading research institutions, the Holmes Group is funded by the Carnegie Corporation and Ford Foundation and the U.S. Department of Education.

Writing for Diverse Audiences

In this section, 1976-1986 IRT products are tallied, including articles published in professional journals, IRT monographs (i.e., Research Series and Occasional Papers), books and monographs, and chapters in books. These totals do not include papers presented at various professional meetings; these were included in the tables discussed earlier.

Type of Product	1976-1986
Publications in professional journals	161
Books and monographs	15
Chapters in books	91
IRT monographs (i.e., Research Series and Occasional Papers)	281

An IRT publications list that cross-references IRT publications and papers published by IRT researchers in journals and books indicates that 37% (or 85) of IRT monographs also have appeared in journals and books subsequent to IRT publication (see Appendix).

As of September 1986, 227 IRT publications were available through the national ERIC system, and 15 more have been submitted but are not yet available. ERIC makes IRT documents available in paper copy and in microfiche, augmenting the IRT's own distribution system and keeping the publications permanently in print. The IRT Publications Catalog continues to cross-reference IRT publication numbers and ERIC document numbers, thus giving catalog users access to the reports through either distribution system.

Publications in Journals and Books

IRT staff publish their research results in a wide variety of both researcher- and practitioner-oriented journals and books. Examples of the researcher-oriented journals that feature IRT research include American Educational Research Journal, American Journal of Education, Anthropology and Education Quarterly, Curriculum Inquiry, Educational Psychologist, The Elementary School Journal, Journal of Curriculum Studies, Journal of Educational Psychology, Journal of Reading Behavior, Journal of Research in Science Teaching, and Teachers College Record. Examples of practitioner-oriented journals that frequently carry articles by IRT researchers include Arithmetic Teacher, Educational Leadership, Journal of Teacher Education, Language Arts, Phi Delta Kappan, Reading Horizons, Reading Teacher, and Theory into Practice.

IRT Monograph Series

Because of the lengthy lag time involved in publishing in journals and books, IRT researchers need a way to make their research findings and ideas available more quickly. The IRT Monograph Series were created for this purpose: Reports of IRT empirical research are in the Research Series; research syntheses, reviews, and analyses appear as Occasional Papers; and reports of IRT-sponsored conferences are in the Conference Series.

The volume of new monographs has picked up considerably over the years. The 10-year total is 281, but in the last six months alone, 23 papers have been published, 6 are in press, and 2 have been submitted for publication. The new papers accompany this report.

Manuals. The IRT has produced several manuals which have proved to be popular for practitioners. Brophy's *Socializing student motivation to learn* (R.S. 169) was ordered by over 1100 readers of *NEA Today*, *Michigan School Board Journal*, or *Learning '86*. Another manual helps teachers with elementary reading groups:

Anderson, L.M., Evertson, C.M., & Brophy, J.E. (1982). *Principles of small-group reading instruction in elementary reading* (O.P. 78).

A set of modules for science teachers includes teaching materials:

Anderson, C.W., & Smith, E.L. (1983). *Transparencies on light: Teacher's manual* (R.S. 130).

Bishop, B.A., Roth, K.J., & Anderson, C.W. (1986). *Evolution by natural selection: A teaching module* (O.P. 91).

Bishop, B.A., Roth, K.J., & Anderson, C.W. (1986). *Respiration and photosynthesis: A teaching module* (O.P. 90).

Brehm, S., Anderson, C.W., & DuBay, J. (1986). *Ecology: A teaching module* (O.P. 94).

Eaton, J., Sheldon, T.H., & Anderson, C.W. (1986). *Light: A teaching module* (O.P. 92).

Hollon, R.E., & Anderson, C.W. (1986). *Heat and temperature: A teaching module* (O.P. 93).

A manual to set up a writing program in elementary and middle schools stresses the connection between reading and writing:

Raphael, T.W., Kirschner, B.W., & Englert, C.S. (1986). *Test structure instruction within process-writing classrooms: Manual for instruction*.

Another manual is being prepared on reciprocal teaching, with a Vygotskian-based teacher-modeling approach to instructing slow readers.

Distribution. Complimentary copies of IRT publications are sent to the IRT and MSU libraries, to OERI, and to the newly established

North Central Regional Educational Laboratory. Members of the advisory panel and the directorate receive abstracts of all IRT publications and may request single copies without charge. Complimentary copies are available, on a single-copy basis, to all IRT and MSU College of Education faculty. Other copies are sold at cost. An average of 4000 publications per year have been sold and another 1000 per year distributed without charge.

Longman Monograph Series

To provide a publication outlet for book-length manuscripts (e.g., reports of major studies, edited state-of-the-art volumes, extensive research synthesis and analysis papers, etc.), the IRT has sponsored a series of Monographs in Research on Teaching published by Longman, Inc.

IRT leadership had long been aware that, although the field was relatively well served by a variety of research journals, it lacked a visible publication outlet for book-length manuscripts (e.g., reports of major studies, edited state-of-the-art volumes, extensive research synthesis and analysis papers, etc.). Consequently, during 1979 and 1980, a plan for the development and sponsorship of a monograph series was created and discussed with several potential publishers. Negotiations eventually reached successful conclusion with agreement by Longman, Inc., to publish the volumes in the series.

IRT sponsors the series by providing editorial review and assistance in manuscript development through an editorial board appointed and chaired by one of the IRT co-directors (originally Lee Shulman, and more recently Jere Brophy). The original agreement with Longman called for potential authors to submit a prospectus to the chair of the editorial advisory board who would screen it for appropriateness for the series (e.g., ascertain that it was a monograph-length scholarly work on teaching), and if so, would circulate the prospectus to the board members for review. When consensus of the editorial board favored publication, Longman would let a contract to the author(s) and a member of the editorial board would be assigned to work with the author(s) in developing the manuscript toward final form (e.g., to serve as a "friendly" external reviewer and source of suggestions). The author(s) would then work with staff of Longman to move the completed manuscript to publication.

Fourteen manuscripts were published between 1981 and 1986 under this agreement with Longman. The authors and titles of the publications in the Longman series are as follows:

Brophy, J.E., & Evertson, C.M. *Student characteristics and teaching*.

Philips, S.E. *The invisible culture: Communication in classroom and community on the Warm Springs Indian Reservation*.

Cooper, H.M., & Good, T.L. *Pygmalion grows up: Studies in the expectation communication process*.

Good, T.L., Grouws, G., & Ebmeier, H. *Active mathematics teaching*.

Slavin, R.E. *Cooperative learning*.

Cahen, L.S., Filby, N., McCutcheon, G., & Kyle, D.W. *Class size and instruction*.

Cusick, P.A. *The egalitarian ideal and the American high school*.

Cuban, L. *How teachers taught: Constancy and change in American classrooms: 1890-1980*.

Natriello, G., & Dornbusch, S.M. *Teacher evaluative standards and student efforts*.

Fisher, C.W., & Berliner, D.S. *Perspectives on instructional time*.

Larrivee, B. Effective teaching for successful mainstreaming.

Morine-Dershimer, G. Speaking, listening, and learning in elementary classrooms.

Spencer, D.A. Contemporary women teachers: Balancing school and home.

Ashton, P.T., & Webb, R.B. Making a difference: Teachers' sense of efficacy and student achievement.

In the previous progress report, it was noted that Longman had decided to phase out this monograph series despite positive critical response to its volumes, as part of a decision to phase out its trade-book operations in education. Consequently, we sought opportunities to continue the series with another publisher and several publishing companies did express interest. In the meantime, however, Longman appointed a new education editor, reconsidered its priorities in the field of education, and expressed willingness to reconsider continuation of the series. Negotiations eventually produced a new agreement that will allow the series to continue with the same essential characteristics (IRT sponsorship, monographs on research on teaching as the content focus, and peer review by an editorial board composed of leading researchers in the field as the basis for approval of prospecti submitted for consideration) but with elements that make it somewhat more attractive for the publisher (slightly reduced author royalty rates and a publisher's option concerning whether or not to let a contract and follow through with publication of potential volumes approved by the advisory board). An especially welcome feature of the new agreement is a provision for release of subsequent volumes in paperback as well as hardback versions. The advisory board for the monograph is presently being restructured, and reviewing of prospecti for future volumes in the series will resume shortly.

Columns

IRT research constitutes a rich source of useful information for practitioners. The IRT editor has written columns on research on teaching for a variety of educational publications. From 1981-1984, the IRT editor wrote a column for Educational Leadership, the journal of the Association for Curriculum Development, describing research of interest to school administrators. In 1984, a similar column began for the Michigan School Board Journal. Until it ceased printing, a monthly IRT column appeared in McREL's publication "What's New in R&D." IRT columns have also appeared in the American Educator and NEA Today.

IRT Communication Quarterly

The IRT Communication Quarterly (combination magazine/tabloid) is one way of reaching the practitioner audience by stressing results and implications rather than the research process. Written with busy practitioners in mind, all the articles are clear, concise, and nontechnical.

Three regular issues are produced and distributed on a complimentary basis each year. The IRT Publications Catalog serves as the fourth issue. Each regular issue of the newsletter contains one article dealing with the IRT as a whole (e.g., the intern training program, teacher collaboration), an announcement of recent IRT publications, a column written by a teacher collaborator (recent columns have focused on intelligent use of research findings by teachers), and four to six research articles. The research articles either discuss the recent findings of an IRT project, review an IRT publication, or report an IRT colloquium.

Nearly 10,000 people, representing all 50 states and over 20 foreign countries, receive IRT Communication Quarterly. Our actual readership is much higher, though, because many people share the newsletter with their colleagues. Education editors who receive IRT Communication Quarterly sometimes list IRT publications in their own magazines, journals, or newsletters. They also reprint articles so that IRT research is disseminated much farther than we could deliver. A 1984 survey of IRT Communication Quarterly readers indicated that 22% are K-12 teachers, 25% K-12 administrators, 23% are teacher educators, and 10% are researchers. Other groups represented are education editors, students, librarians, R & D Centers, state and federal government officials. In 1985 when readers indicated whether they wished to remain on the mailing list, the comments received were overwhelmingly positive.

Notes & News

The IRT publishes a newsletter, Notes & News, to keep those affiliated with the IRT informed about its progress. Notes & News is sent fortnightly to all IRT staff and others who have asked to receive it. At present, we have over 400 subscribers. Each issue contains brief items about IRT events and the professional activities of IRT staff. Each issue also features an article about either an IRT research project or colloquium presentation. Notes & News is read (completely and quickly) by most if not all IRT staff. As such it serves as an effective and efficient method to keep staff apprised of recent developments across the projects.

Research Training

Research on teaching is a very young field. Over 90% of the scholars who consider themselves researchers on teaching today were not doing research on teaching in 1976 when the IRT began its work. A decade ago, the idea of a separate division for research on teaching and teacher education within the American Educational Research Association would not have occurred. Now research on teaching is widely regarded as one of the most productive and important fields of educational research. IRT's research training efforts have been an important part of building this new field of inquiry.

The Training Challenge

In 1974 the National Institute of Education identified the improvement of teaching as an essential component of its efforts to strengthen American education. In the following year, the NIE identified the scholars who were doing significant work in research on teaching and brought them together for a series of meetings in San Diego. Only a handful could be identified and none were minority researchers. The meeting was the first time researchers on teaching had assembled to discuss each other's work and to consider collectively future directions.

Not only was the number of researchers on teaching small when the IRT began its work, the disciplinary perspectives brought to bear on understanding teaching and how it might be improved and the methodological approaches employed in research on teaching were extremely narrow. Most research on teaching was done by psychologists trained to study learning and cognition. The methodological approaches employed were even more narrowly circumscribed. Low inference measures of teachers' behaviors based on structured classroom observations were correlated with student achievement in studies of natural variation. Some of this early work made important contributions to our understanding of teaching, but building a knowledge base on teaching that can support comprehensive educational improvement requires a much more catholic and comprehensive research and development agenda.

In short, 10 years ago when the IRT set out to build a knowledge base on teaching that would support improvements in education, the goal was clear but the challenges were great. Much more than a promising research agenda was required. Additional scholars were needed to pursue that agenda. The hope was to build a new field of inquiry, a field that would draw upon a variety of disciplinary perspectives and methodological approaches in pursuing new understandings of teaching.

From the beginning, the IRT set about the task of attracting some of the best minds in the social sciences to pursue the institute's research on teaching agenda. Excellent practitioners were also recruited. While successful, these efforts were necessarily incomplete. If research on teaching were to become a field of inquiry in its own right, making the contributions to knowledge envisioned, a new type of educational researcher would be required. To address this need, the IRT began its research training efforts with the following goals:

> To identify and recruit bright new people from a variety of academic backgrounds and cultures into careers in research on teaching.
>
> To structure and augment their individual programs of advanced graduate study to ensure strong academic grounding in (a) the disciplinary perspectives important to research on teaching and (b) the methodological approaches that might usefully be applied.
>
> To provide research internships and mentoring that intellectually and emotionally engage them in IRT's unique learning community: focusing on enduring problems of practice, recognizing the clinical components of teaching, and collaborating with practitioners.
>
> To assist them in taking their place among productive researchers of teaching and in becoming future leaders in the field.

Three Interrelated and Partially Overlapping Programs

"To prepare research on teaching personnel at the graduate level [as one of several means of research dissemination]" was one of three major missions given to the IRT when it began in 1976. In response, three formal programs of research training have been initiated and completed, two at the predoctoral level and one at the postdoctoral level.

Predoctoral program: The first five years (1976-1981). During its initial year of operation, the IRT recruited 23 currently enrolled doctoral students from education and the social science areas to become research interns. The criteria for selection included academic promise and commitment to research on teaching as a professional career choice. These initial interns were in various stages of having completed a doctoral program. All participated in a weekly noncredit seminar that covered a variety of topics related to research on teaching, most of which were presented by the interns themselves. All served as graduate assistants on an IRT project (approximately 18 hours per week). All were expected, as a part of participation in the IRT training program, to do their dissertation on some aspect of research on teaching.

In subsequent years, modifications were made to the program. The frequency of the noncredit seminars was reduced and finally they were discontinued. A program of visiting scholars from other campuses was initiated. Modest support for interns to participate in professional meetings (e.g., the annual meeting of the American Educational Research Association) was initiated. The number of interns in residence at any one time was gradually reduced in recognition of the heavy demands of providing research training, both financial and on senior researcher time.

Postdoctoral program (1979-82). In 1979 the IRT expanded its formal training efforts to include a postdoctoral program. The goal was to increase the number of minorities and women in the field of research on teaching. Many of the program's design features were motivated by earlier experiences with the predoctoral training program. Andy Porter, who was directing the predoctoral program, was joined by Jacquie Nickerson in designing and coordinating the postdoctoral effort.

Postdoctoral fellows were drawn from three distinct populations to participate in the two-year program: faculty from Morgan State

University, a traditionally black institution; faculty from Michigan State University; and recent Ph.D. recipients recruited nationally. Participants were in residence full time on the Michigan State campus during the first year of the training experience. They began research collaboration with a mentor, participated in a specially designed research seminar, interacted with visiting scholars who were minority researchers, and participated in formal coursework. Heavy emphasis was given to technical writing. In their second year of the training experience, fellows began (or returned to) full-time employment while continuing to collaborate with their IRT mentor.

Through the program's three entering cohorts, 15 postdoctoral fellows were introduced to careers in research on teaching. Thirteen of the participants were minorities and two were white females. While these numbers may seem small, the limited number of persons specializing in research on teaching and the almost total lack of minorities among them argues to the contrary. The positive impact upon IRT's learning community was nearly as great. During the three-year period in which postdoctoral fellows were in residence at the IRT, not only was their own presence felt but during the same period, virtually every nationally visible minority educational researcher came on campus as a part of the visiting scholars program.

Predoctoral program: The second five years (1981-1986). For its second five-year contract with the federal government, the IRT designed a new predoctoral program for research training. The training experiences for this program reflected lessons learned from both of the institute's earlier training efforts and was designed and coordinated by Porter and Nickerson.

The training program complemented and extended each intern's program of doctoral study. As in the case of the earlier training efforts, a carefully supervised and structured research internship with an IRT project formed the core of the training experience. Interns also participated in special noncredit seminars on research on teaching and interacted with selected visiting scholars from across the nation.

Several important changes from the earlier training efforts were introduced. Recruitment was proactive. Individuals were first selected to become IRT interns and then admitted to a program of doctoral study. Thus, each year a cohort of new interns began their doctoral study at the same time that they began their internship in research on teaching. The power of recruitment was strengthened by offering a three-year program with financial support promised for each year. Finally, a much greater emphasis was placed upon developing professional writing and speaking skills and in practicing those skills through publication and presentations at national professional meetings.

Nonformal training. At the IRT, research training for graduate students has extended well beyond the formal program boundaries in two ways. First, many more doctoral candidates participated as graduate assistants in IRT research than the limited number of interns. All of these graduate assistants profited professionally as well as financially from their collaboration with IRT senior researchers and teacher collaborators. Many of them jointly published with senior researchers and made presentations of IRT work at national professional meetings. Second, all IRT senior researchers have academic appointments in the university and teach in addition to conducting IRT research. As a result, IRT research philosophy and research results permeate doctoral study in the College of Education (and to some extent beyond the College of Education to programs in economics, anthropology, sociology, and medical education).

Nonformal research training has also occurred at the postdoctoral level. Two or three visiting professors typically are in residence at the IRT at any one time. The length of stay has varied from as short as one month to as long as a full year. Visitors have come from a variety of fields, not just research on teaching, and from across the nation as well as internationally. During their stay, these visitors have joined IRT's intellectual community, interacting with projects and staff, and participating in IRT colloquia.

Teacher educators form yet another identifiable group that has benefited from nonformal IRT research training. From the very beginning, the IRT was designed to be an integral part of the College of Education, not apart from the college. Senior researchers' offices are located with the offices of other faculty in their academic department, not in a centralized suite of IRT offices. Most of IRT's senior researchers provide instruction in the college's undergraduate teacher education programs. As a result, teacher educators at Michigan State University interact daily with IRT senior researchers and draw heavily upon IRT research in preparing their courses.

Teachers also participate nonformally in IRT research training. The most direct and powerful form of participation has been through teacher collaboration. Eighteen K-12 teachers have served as teacher collaborators, spending half time in residence at the IRT for one or more years. Through their participation in IRT research projects, they have gained research skills and a unique understanding of the potential relationships between research and practice. As these teacher collaborators interact with their colleagues, there is a substantial ripple effect upon other teachers in their understanding of and appreciation for the interplay between improved practice and research.

Important Program Elements

Internship experience and mentoring. The foundation of IRT training has been research collaboration. Participation on research projects and collaborative experiences were designed to bring about a full understanding of what it means to conduct research on teaching. Interns and fellows engaged in data collection, analysis, and interpretation. They were involved in the writing of progress reports and proposals. Involvement as an active member of a research team provided in-depth exposure to and experience with a particular research methodology. Socialization to the role of researcher took place through modeling and active learning. Through these experiences, each intern learned and practiced many of the skills that he or she had studied in courses.

Interns and fellows established "mentor/mentee" relationships with IRT senior researchers which have continued as their professional careers progress. Close associations on a day-to-day basis provided opportunity for useful dialogue that promoted deeper understanding of the role and responsibility of the educational researcher. This relationship facilitated induction into the research community and promoted a sense of membership for the novice.

Research seminars. Special research seminars were designed to augment the university course offerings included in the typical doctoral program. The noncredit seminars were initiated as part of the IRT Postdoctoral Research Training Program for Minorities and Women and continued as part of the intern training program that followed. The purposes of the research seminars were to create a sense of community among the interns and fellows and to expose them to the variety of substantive issues and methodological approaches represented by IRT research projects.

Several seminars consisted of IRT senior researchers describing their research through assigned readings and a brief presentation and then entertaining questions during a discussion format. Other seminars dealt with topics such as peer review and the publication process, technical writing, preparation of a professional resume, and the job interview process. Interns also were required to take a credit seminar on research on teaching from IRT Senior Researcher Christopher Clark.

Because interns and fellows were separated by their choice of major and by their assignments to different IRT projects, the research seminars provided an essential opportunity for them to come together to interact, exchange ideas, and begin to strengthen their commitment to research on teaching as an area of inquiry. Through the seminars they gained a broad understanding of the work in the IRT and its relationship with work elsewhere. They also gained important understandings of the "hidden curriculum" of learning to become a researcher.

Visiting scholars. The visiting scholar component of IRT research training was designed to provide opportunity for interns and fellows to interact with outstanding scholars from other locations whose work has influenced in some substantial way research on teaching. Scholars were jointly selected by the interns and the training coordinators and represented a wide variety of research interests and approaches.

Each visiting scholar came to campus for a two-day period. Prior to the visit, interns and fellows studied the writings of the visitor. The visit generally included two seminars, open only to the interns, during which the scholar's work was discussed; an all-university presentation that was open to members of the MSU academic community; and an informal social gathering at which interns, IRT staff, and the visiting scholar had opportunity to become better acquainted and exchange ideas.

The 43 researchers that have served as IRT visiting scholars represent a unique intellectual resource to the IRT, the college, and the university. For example, at no other time in the history of Michigan State University has there been such visibility for and recognition of the accomplishments of minority researchers during the three-year period of IRT's postdoctoral training program when 15 minority visiting scholars brought to campus. The entire university community was positively affected by their presence. Professional relationships between MSU faculty and the visiting minority researchers have continued. One of the visiting minority scholars, Ron Edmonds, was subsequently recruited to join the college's faculty.

Professional writing and speaking. Throughout IRT research training programs strong emphasis was placed on professional writing and speaking. Interns were encouraged to pursue these activities as early in their training as possible, since it was recognized that novice researchers often experience difficulty in this process without support, guidance, and opportunity.

Several IRT resources were available which provided valuable assistance to interns and fellows. Involvement in major research projects afforded early opportunity for co-authoring articles for publication in professional journals and for presentation at professional meetings. The IRT editorial staff served as consultants and assisted in the editing of papers and articles. In addition, IRT senior researchers shared their experience and expertise in reviewing written products. Finally, the interns, fellows, and the co-coordinators constituted a support group which reinforced and reacted to writing and speaking ideas.

Some formal instruction in technical writing was provided through research seminars led by the IRT editorial staff. These seminars focused on problem areas related to scientific writing. Interns and fellows presented samples of their writing for critical review and feedback. Copies of the APA Publication Manual, The Elements of Style by Strunk and White, and A Handbook for Scholars by VanLeunen were received and discussed.

Required Resources for Research Training

Research training at the IRT has not been without its costs and these too must be recognized. There are the obvious financial costs: stipends for research interns or postdoctoral fellows, honoraria for visiting scholars, travel and per diem to support participation in professional meetings. While essential, these costs are easily calculated and unlikely to be underestimated.

Less obvious are the administrative costs. A high-quality research training program involving several distinct components requires administrative leadership. One or two senior researchers must accept the responsibility for designing and running a training program. An administrative assistant who lacks stature in local and national research communities will not have the insights nor the authority to ensure that research training proceeds as designed (e.g., that a research mentor is fulfilling his or her obligations). The level of required administrative support has varied over time but ranged between a quarter-time and a half-time assignment for a senior researcher.

The most important resource for research training, however, has been the strength of IRT's research programs and research staff. IRT's approach to research training has not been through formal coursework. Rather, its approach has been to assimilate young scholars into its intellectual community so that they learn first hand what it means to work collaboratively with practitioners toward the goal of understanding teaching in new ways that hold promise for the improvement of practice. Thus, an essential resource that must not be taken for granted is the time and commitment of senior researchers to work with interns and fellows. Research interns and fellows are not just graduate assistants. Senior researchers must give careful consideration to research training needs as they plan and execute their own programs of research. Time must be spent explaining why certain research approaches have been preferred over others. Opportunities must be created to ensure that each intern participates in each phase of the research process. Invitations must be extended for preparing and submitting co-authored publications.

The Effects. What Was Accomplished

Increasing the number of researchers studying teaching. IRT research training programs have strengthened the field by recruiting a new population to research on teaching, one that has been instilled with IRT understanding and skills. During the 10-year history of the IRT, 69 predoctoral interns and 15 postdoctoral fellows participated in IRT training for a total of 74 participants. The characteristics of the new population are telling in terms of diversity. Over half of the interns have been women and approximately one-third have been minorities. Fellows and interns came from a variety of backgrounds including anthropology, business, educational psychology, home economics, counseling psychology, science education, sociology, special education, teacher education and vocational education. Each came with a different set of experiences and personal goals and thus brought elements of diversity to the IRT research community. The IRT, and subsequently the field of research on teaching, has been enriched by their involvement.

Research training as a powerful form of dissemination. As stated previously, IRT's goals go well beyond conducting and disseminating results from specific research studies. The IRT has sought to build and provide intellectual leadership to a new field. Printed material can be an effective and certainly efficient way to disseminate specific research findings and even their implications, but disseminating a research agenda and a way of pursuing that agenda requires much more powerful mechanisms of dissemination.

IRT's training programs have proven to be a powerful form of dissemination. As IRT interns and postdoctoral fellows have joined the educational research community, they have taken with them their unique knowledge of IRT research. In most cases, they have continued to pursue IRT's research agenda in their own work. Through their collaboration with colleagues and through their own graduate students, they have brought knowledge of IRT research results and their implications for practice to many hundreds of people: researchers, prospective researchers, practitioners, and policymakers.

To a lesser extent, the visiting scholars portion of IRT's research training programs has also facilitated dissemination of IRT research. By coming to Michigan State and interacting with IRT interns and senior researchers, these nationally recognized figures have come to understand IRT's programs of research and specific findings in ways that would have been impossible through printed materials alone. Because the visiting scholars have been highly visible and influential people, their subsequent references to IRT work as they write and speak has contributed greatly to the high level of interest in IRT publications and presentations.

Research training as a means of strengthening IRT's research staff. Like any university-based program of research, the quality and efficiency of IRT research has been in part dependent upon the Strength of the doctoral candidates who serve as graduate assistants. IRT's highly visible and attractive research training programs have made it possible to recruit outstanding doctoral students, not only from education but from other areas of the social sciences. Especially in the second five-year program for predoctoral training, research fellowships were advertised and promoted nationally and competition for selection was intense. Students of extremely high academic promise who otherwise would not have been attracted to doctoral study at Michigan State were brought to campus to work on IRT research. Furthermore, the commitment to recruiting students from a variety of disciplines and cultures generated a cadre of graduate assistants that brought their own unique perspectives to the planning, conduct, and interpretation of IRT research.

The high quality of doctoral students attracted to university programs through IRT research training efforts had an important secondary effect as well. University faculty are happiest when they can teach, work with, and be mentors for extremely bright, energetic graduate students. The mid-1970s to the mid-1980s was a period during which competition for good doctoral students in education was especially keen. Because of the IRT's strong national reputation, because of the financial support available, and because of the unique nature of IRT's research training, IRT senior researchers have had access to topflight graduate students.

Creating new horizons for those who have participated in IRT research training has been another important outcome. The education, support, and encouragement given to interns and fellows have helped to open many doors to professional opportunities and recognition. Of course, it is too early to judge the professional achievement of those who participated in IRT training. It has been only seven years since the earliest interns completed their degree programs and assumed professional positions; a dozen of the most recent interns are still doctoral candidates in the process of completing their degrees. Yet, the early signs are most encouraging.

IRT interns have received a variety of awards for their research on teaching, from college recognition for Outstanding Dissertation of the Year to the prestigious award of a Spencer Fellowship in recognition of the nation's most promising young scholars in education. IRT interns and fellows' names appear regularly on the programs of national research organizations, most notably the American Educational Research Association. Early publications co-authored with IRT senior researchers and based on IRT research are giving way to publication of work initiated since leaving the IRT. More than half of those who have completed their doctoral programs are located in universities where they have access to support for pursuing their research programs. An important minority have opted to apply their research expertise in direct service of educational improvement and have become leaders of state, local, and professional education organizations.

Research training in the IRT has given these former interns and postdoctoral fellows a head start in their professional careers. In turn, their emerging leadership among educational researchers and practitioners is strengthening the contributions of research on teaching to the improvement of educational practice.

Research and Dissemination Support Services

To support the research, communication, and dissemination functions of the IRT, a number of special services are provided. These services support all of the projects and are only possible because we are an institute rather than a collection of separately funded projects.

The IRT's organizational capabilities include a close, working relationship with MSU's College of Education; close relationships with key groups of teachers, teacher educators, policymakers, and educational researchers; strong relationships with local school districts; and access to a representative cross section of schools, students, and teachers. Some specific support services offered to IRT researchers are described below.

Library Services

The IRT's research collection is a specialized library that has developed concurrently with the IRT. IRT researchers rely on the collection for many of the printed materials--published or unpublished--that they need for research synthesis and analysis activities. Staff members are encouraged to forward requests for books, journals, research reports, and other printed materials to David Bolig, the IRT information specialist. The requested items are then ordered, added to the collection, and entered into the computerized catalog system.

In addition, the information specialist regularly scans incoming periodicals, monographs, and other sources to keep informed about recent publications in relevant subject areas; such publications are ordered to supplement researchers' requests and to help create an in-depth collection that will support faculty projects.

The IRT research collection contains a wide variety of recent reports, books, and journals and emphasizes the ethnographic, evaluative, and psychological aspects of research on teaching. As of August 1986, the collection held over 2,600 items. Presently, 63 non-newsletter periodicals are also received.

This set of up-to-date materials provides IRT researchers and visitors with an excellent base of bibliographic resources. To keep IRT staff apprised of new additions to the collection, the information specialist periodically compiles and distributes a list of recent monographic acquisitions. A separate monthly compilation of the tables of contents of all currently received journals is also distributed to IRT faculty.

The combination of current-awareness services, high-quality current materials, and convenient location facilitates faculty use of the collection for research analysis and synthesis. The information specialist also assists IRT staff in using the main MSU library to conduct literature reviews, search data bases, and obtain needed materials. Printed materials not available on campus are obtained from other libraries in the United States through the campus interlibrary loan system.

Over the past 10 years, the research collection has grown from a bookshelf with a few dozen books and reports to a library over 100 times that size. The resources in the collection and the information services provided to facilitate their use have served IRT researchers well, by providing an extra margin of quality, completeness, and timeliness that would not otherwise have been available in the bibliographic support of faculty research. At the same time, visiting scholars as well as local faculty, students, and schoolteachers have benefited from their extensive use of the collection, even though these individuals were not affiliated with the IRT. While difficult to measure, these internal and external influences by the collection have been both real and valuable to educational researchers and to the education community in general.

Editorial Staff

The IRT employs a full-time editor (Sandra Gross) and a half-time assistant editor (Sally Pratt who replaced Pat Nischan in April 1986). In addition to editing all the IRT publications, preparing the IRT's two newsletters, producing brochures, updating the IRT's publications list, and writing articles about IRT research, they provide editorial support to all IRT staff. The editor schedules and publicizes colloquia and answers requests for information on IRT projects. Since Fall 1985 a student intern has been assisting with the bimonthly newsletter.

In September 1985, the editor assumed the duties of the quarter-time media specialist: coordinating requests for inservice workshops and visits to the IRT, preparing display cases about IRT research for the building lobby (changed every 6-8 weeks), sending publicity about colloquia to local educators, serving as liaison to the MSU News Bureau for media coverage, and orienting foreign visitors to the work and publications of the IRT. From 1985-1986 the IRT hosted visitors from Latin America, Africa, Canada, Australia, and Europe. Dorothy Prawat, former quarter-time IRT media specialist, hires photographers for use by the IRT. The editor schedules and coordinates photographers for IRT assignments.

Project Manager

Additional support for IRT research and dissemination activities is provided by the project manager, Gail Nutter, who coordinates technical and clerical staff efforts related to the preparation of IRT materials and arrangements for special activities. Arrangements for conferences, meetings, and support services for visitors are handled through the office of the manager. The manager also serves as a resource person regarding established policies and procedures, assists with recruitment and orientation to the IRT for interns and teacher collaborators, and serves as a liaison with MSU personnel and outside vendors who provide services to support IRT dissemination activities.

Information Processing Support

Beginning in 1983 the IRT staff have had access to the College of Education's Information Processing Group (IPG), a central resource of computer-related expertise. Under the direction of Laurence Bates, the IPG staff are available to help IRT researchers with data collection, organization, storage, and analysis. The IPG staff are familiar with the latest techniques relating to computer networking, optical character readers, and point of collection data input into hand-held computer interfaces. They have considerable skill in the use of both mainframe and microcomputer data-base management packages. They provided programming for computer storage of the IRT library catalog. Their expertise in both mainframe- and microcomputer-based statistical analysis packages is of considerable benefit to IRT researchers.

Appendix

1976-1981 Activity Tables

1982-1986 Activity Tables

Publications List

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1976-1981 Activity Tables

Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
Professional Assoc./Conf. **Research & Evaluation**			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T Ed	Other
1. Nat'l/Intern'l (AERA, APA, ASA, NCME Nat'l Reading Conference)	1981-82	3135	37			2	8	6	38	18	3
	1983	3524	55	3	3		14	8	63	29	2
	1984	1922	44			4	9	7	44	29	5
	1985	4512	50	3		6	13	7	58	38	2
	1966	4254	43	1		15	20	20	53	57	4
2. Regional (NERA, Midwest-ERA)	1981-82										
	1983	--									
	1984	60	3						3	1	
	1985	--									
	1986	--									
3. State (MERA, Mi. Sch. Testing Conference)	1981-82	30	2				2	2			
	1983	1596	10				6	10	7	6	
	1984	--									
	1985	--									
	1986	150				1	1	1	1	1	
Teacher/Administrator											
1. Nat'l/Intern'l (NEA, AFT, ASCD, IRA, NCTE)	1981-82	824	9			1	5	4	2	5	1
	1983	1077	10	1	1	1	7	10	5	5	2
	1984	24	1				1	1		1	
	1985	--									
	1986	425	4				3	1	4	3	

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NOTE: This category is multiply coded.

Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
Tcher/Admntr,(cont'd)			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
2. Regional (NW Educ. Cooperative)	1981-82	90		2				2		1	1
	1983	--									
	1984	--									
	1985	1895	4			1	3	4			
	1986	--									
3. State/Local (MEA, Mi. Rdg. Assoc.)	1981-82	3025	20	4			18	14		4	6
	1983	8965	25	1		2	22	21	3	10	2
	1984	2520	19	1			14	14	5	11	2
	1985	--									
	1986	100	1				1				
Teacher Educator											
1. Nat'l/Intern'l (NCATE, AACTE, ATE)	1981-82	305	8	1				1	1	6	3
	1983	1245	11				2	2	4	11	
	1984	802	11	3			5	4	9	14	1
	1985	183	5				1		4	6	
	1986	--									
2. Regional (MW Assoc. of Tchrs. of Ed. Psych., W. Canad. Assoc. for Stdnt. Tch.)	1981-82	--									
	1983	--									
	1984	--									
	1985	183	5				1		4	6	
	1986	200	1			1				2	

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
Tchr. Educator (cont'd)			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
3. State	1981-82	135	1			1					
	1983	80	2				1	1	1	1	
	1984	195	3	1			2	1	3	3	
	1985	30	1				1		1	1	1
	1986	60	3	1			2	1	2	2	2
Public Institutions/ Agencies											
K-51 1. Nat'l/Intern'l (NIE, Nat'l Assess. of Educ. Progress)	1981-82	235	1			2	1		2	1	2
	1983	948	7	3	3		9	5	4	6	6
	1984	400	5	1			1	2	2	1	3
	1985	466	6		2	4	7	3	9	8	6
	1986	310	4			2	2	1	3	3	2
2. Regional (CEMREL, Far West Lab.)	1981-82	40	1				1	1			
	1983	--									
	1984	--									
	1985	--									
	1986	--									
3. State (State Depts. of Ed., Universities)	1981-82	7482	27		1	1	9	8	18	19	
	1983	1800	22	4	2	1	11	8	17	11	1
	1984	3263	39		1	1	23	16	32	24	11
	1985	1443	18	3	4	1	13	17	16	18	8
	1986	560	2	2	2	3	7	3	6	9	

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
Public Inst./Agencies (cont'd)			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
4. Other	1981-82	--									
	1983	--									
	1984	--									
	1985	90	2		1		1		2	2	1
	1986	--									
Private Institutions/ Agencies											
1. Nat'l/Intern'l (ETS, Res. for Better Schools, Inc., Ford Foundation)	1981-82	75	1								1
	1983	75	1						1	1	1
	1984	75	3					1	1	1	2
	1985	35	1				1		2	2	1
	1986	15			1			1			
2. Regional or State	1981-82	--									
	1983	--									
	1984	--									
	1985	--									
	1986	--									
3. Other/Can't Tell	1981-82	30	1	1			1	1	1		
	1983	--									
	1984	--									
	1985	37	2								4
	1986	--									

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
Public Schools/ Systems											
Michigan											
Local Area	1981-82	683	4	8	3	2	10	16			
	1983	284	4	4	4	2	8	12		1	
	1984	136	3	2	3		4	5		1	1
	1985	15	1					1			1
	1986	271	3	4		1	1	5			1
Detroit/Flint	1981-82	1499	5	14	1		13	20		1	2
	1983	662	5	6	1		8	13			2
	1984	387	3				1	3			
	1985	24			2		1	2	1	1	
	1986	15		1			1	1			
Other	1981-82	2465	11	12	8		24	25			3
	1983	1618	14	11	8		23	26			
	1984	288	1		2		4	3			
	1985	--									
	1986	--									

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
Public Schools/Systems											
Other States											
Midwest	1981-82	1690	1	6			6	7			
	1983	620	3	3	1		4	5			
	1984	200	1				1	1			
	1985	--									
	1986	--									
East	1981-82	150		1			1	1			
	1983	420	1	3			4	3			
	1984	35			1		1	1			
	1985	--									
	1986	--									
South	1981-82	2380	6	2			7	8			
	1983	145	2				1	1			1
	1984	--									
	1985	--									
	1986	40	1		1		1				
West and Southwest	1981-82	1050	3				3	3			
	1983	258	1		1		1	2			
	1984	80			2		1	2			
	1985	--									
	1986	--									

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1982-1986 Activity Tables

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
Professional Assoc./Conf. Research & Evaluation			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
1. Nat'l/Intern'l (AERA, APA, ASA, NCME Nat'l Reading Conference)	1976-77	335	5				2	1	5	3	
	1978	835	7	4			4	5	12	6	
	1979	2180	31	2		3	10	6	34	11	
	1980	2500	35	2		1	11	9	25	17	4
	1981	4625	30	2	2	5	8	8	26	14	2
2. Regional (MERA, Midwest-ERA)	1976-77	--									
	1978	--									
	1979	210	3				1	1	2	1	
	1980	200	1						1		
	1981	230	2						2	1	
3. State (MERA, Mi. Sch. Testing Conference)	1976-77										
	1978	75	1				1	1			
	1979										
	1980	315	6				4	6	4	4	
	1981	65	2				1	1	2	1	
Teacher/Administrator											
1. Nat'l/Intern'l (NEA, AFT, ASCD, IRA, NCTE)	1976-77	--									
	1978	460	3				3		2	2	1
	1979	1475	7				9	2	4	7	
	1980	605	10		1		9	3	5	7	1
	1981	755	5	1			6	1	4	7	

NOTE: This category is multiply coded.

Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
Tchr./Admntr. (cont'd)											
2. Regional (NW Educ. Cooperative)	1976-77	--									
	1978	--									
	1979	50	1					1			
	1980	40				1		1	1	1	1
	1981	--									
3. State (MEA, Mi. Reading Assoc.)	1976-77	--									
	1978	205	5		1		5	2	1	4	
	1979	250	4			1	5	2		3	
	1980	305	7			1	8	6		4	1
	1981	310	4	3			5	4	1	2	2
Teacher Educator											
1. Nat'l/Intern'l (NCATE, AACTE, ATE)	1976-77	--									
	1978	--									
	1979	695	5				2	2	3	5	
	1980	75	2						1	2	
	1981	602	9	2			1	1	5	7	2
2. Regional (MW Assoc. of Tchrs. of Ed. Psy., W. Canad. Assoc. for Stdnt. Tch.)	1976-77	--									
	1978	50	1							1	1
	1979	--									
	1980	45	2							1	2
	1981	25		2						1	1

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
Tchr. Educator (cont'd)											
3. State	1976-77	--									
	1978	--									
	1979	--									
	1980	--									
	1981	47	2							2	1
Public Institutions/Agencies											
1. Nat'l/Intern'l (NIE, Nat'l Assess. of Educ. Progress)	1976-77	--									
	1978	70			2				2		2
	1979	185	3						3		2
	1980	80	2	1					3		1
	1981	307	5		1		2	2	4	1	4
2. Regional (CEMREL, Far West Lab.)	1976-77	--									
	1978	180	2				1	1	2		1
	1979	12			1				1		
	1980	130	2		2		1	1	4	1	1
	1981	265	4		1		2	2	2		1
3. State (State Depts. of Ed., Universities)	1976-77	200	2				2		2	2	
	1978	175	2		1		1	1	3	1	2
	1979	127	5	1					4	2	3
	1980	635	9	3	2	2	6	7	10	10	4
	1981	1464	16	3	2	3	12	6	14	13	4

Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
Private Institutions/Agencies			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
1. Nat'l/Intern'l (ETS, Res. for Better Schools, Inc., Ford Foundation)	1976-77	--									
	1978	20	1						1	1	
	1979	--									
	1980	25		1			1		1	1	1
	1981	--									
2. Regional or State (Kamehameha Early Ed. Proj.--Hawaii)	1976-77	--									
	1978	--									
	1979	--									
	1980	--									
	1981	20	1				1			1	
3. Other/Can't tell	1976-77	--									
	1978	25			2		1		2	1	
	1979	48		2	1		2	2		1	
	1980	10			1				1	1	
	1981	--									

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Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
Public Schools/Systems											
Michigan											
Local Area	1976-77	--									
	1978	70	2	1			2	2			
	1979	50		2			2	1			
	1980	254	6	2	1	2	8	10			1
	1981	359	4	2	4	1	8	6			2
Detroit/Flint	1976-77	--									
	1978	--									
	1979	--									
	1980	65	1		1		1	1			
	1981	295	4	1			4	4			
Other	1976-77	30	1							1	
	1978	78		2			2	2			
	1979	--									
	1980	--									
	1981	150	2				2	2			

K-60

Sponsor of Presentation	Total Audience (by year)		Type of Presentation				Characterization of Audience				
			Paper	Wkshp	Cons	Other	Tchrs	Sch St	Res	T.Ed	Other
Public Schools/Systems											
Other States											
Midwest	1976-77	--									
	1978	--									
	1979	--									
	1980	480	1	1			2	2			
	1981	900	2				2	2			
East	1976-77	--									
	1978	--									
	1979	30	1				1	1			
	1980	--									
	1981	265	1		1		1	2			
South	1976-77	--									
	1978	--									
	1979	35	1				1				
	1980	--									
	1981	--									
West and Southwest	1976-77	--									
	1978	--									
	1979	--									
	1980	10			1		1	1			
	1981	--									

Addendum to Publications List

of the Institute for Research on Teaching
College of Education, Michigan State University
East Lansing
November 1986

Following are IRT publications organized by project which have been published since release of the Summer 1986 list.

Classroom Strategy Research

Brophy, J. (1986). *On motivating students* (Occasional Paper No. 101), $7.00.

Conceptual Analytic

Buchmann, M. (1986). *Teaching knowledge: The lights that teachers live by* (Occasional Paper No. 106), $3.00.

Floden, R.E. (1986). *Explaining learning: Biological and cybernetic metaphors* (Occasional Paper No. 99), $2.50.

Zeuli, J.S. (1986). *The use of the zone of proximal development in everyday and school contexts: A Vygotskian critique* (Occasional Paper No. 100), $2.50.

Zeuli, J.S., & Buchmann, M. (1986). *Implementation of teacher thinking research as curriculum deliberation* (Occasional Paper No. 107), 22 pages, $3.00.

Content Determinants

Porter, A.C., Floden, R.E., Freeman, D.J., Schmidt, W.H. & Schwille, J.R. (1986). *Content determinants* (Research Series No. 179), $3.00. *(with research instrumentation appendices)*, $11.00.

Schwille, J., Porter, A., Alford, L., Floden, R., Freeman, D., Irwin, S., & Schmidt, W. (1986). *State policy and the control of curriculum decisions: Zones of tolerance for teachers in elementary school mathematics* (Research Series No. 173), $4.00.

Knowledge Use in Learning to Teach

Ball, D.L., & Feiman-Nemser, S. (1986). *Using textbooks and teachers' guides: What beginning elementary teachers learn and what they need to know* (Research Series No. 174), $3.50.

Feiman-Nemser, S., & Buchmann, M. (1986). *Knowing, thinking and doing in learning to teach: A research framework and some initial results* (Research Series No. 180), $3.00.

Feiman-Nemser, S., & Buchmann, M. (1986). *When is student teaching teacher education?* (Research Series No. 178), $4.00.

Science Teaching

Anderson, C.W., & Smith, E.L. (1986). *Teaching science* (Research Series No. 168), $4.50.

Roth, K.J. (1986). *Conceptual-change learning and student processing of science texts* (Research Series No. 167), $4.00.

Improving Reading and Writing/ Teaching Expository Reading and Writing

Raphael, T.E., Englert, C.S., & Kirschner, B.W. (1986). *The impact of text structure instruction and social context on students' comprehension and production of expository text* (Research Series No. 177), $3.50.

Raphael, T.E., Kirschner, B.W., & Englert, C.S. (1986). *Students' metacognitive knowledge about writing* (Research Series No. 176), $4.00.

Raphael, T.E., Kirschner, B.W., & Englert, C.S. (1986). *Text structure instruction within process-writing classrooms: A manual for instruction* (Occasional Paper No. 104), $9.25.

Written Literacy

Florio-Ruane, S. (1986). *Conversation and narrative in collaborative research* (Occasional Paper No. 102), $3.50.

Other Research

Melnick, S.L., & Raudenbush, S.W. (1986). *Influence of pupils' gender, race, ability, and behavior on prospective and experienced teachers' judgments about appropriate feedback* (Research Series No. 175), $3.50.

PUBLICATIONS

of the Institute for Research on Teaching
College of Education, Michigan State University
Summer 1986

Following are the publications of the Institute for Research on Teaching. They are organized by project and, within each project, by type of publication. **IRT Publications** can be ordered from the IRT. (See order form at the end of this list.) Publications listed under **Articles Available Only in Journals and Other Periodicals** may be available at your library. If you are unable to locate any of these articles in your library, you may write to the senior author for a reprint. Publications listed under **Books and Chapters in Books** may also be available at your library. If not, write directly to the publisher for information on how to order.

Classroom Strategy Research

Researchers working on this project are looking at teachers' thinking about and strategies for managing their classrooms and motivating and encouraging their students. Previous studies focused on how effective teachers deal with problem students; current studies are focusing on procedures teachers can use to increase their students' motivation to learn.

Anderson, L. M., Evertson, C. M., & Brophy, J. E. (1982). *Principles of small-group instruction in elementary reading* (Occasional Paper No. 58). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Brophy, J. (1986). *Socializing student motivation to learn.* (Research Series No. 169). East Lansing: Michigan State University, Institute for Research on Teaching. $4.50

Brophy, J. E. (1983). *Conceptualizing student motivation* (Occasional Paper No. 70). East Lansing: Michigan State University, Institute for Research on Teaching, $3.50. **(Also published in *Educational Psychologist*, 1983, *18*, 200-215.)**

Brophy, J. E. (1982). *Classroom organization and management* (Occasional Paper No. 54). East Lansing: Michigan State University, Institute for Research on Teaching, $4.50. **(Also published in *Elementary School Journal*, 1983, *83*, 265-285).**

Brophy, J. E. (1982). *Fostering student learning and motivation in the elementary classroom* (Occasional Paper No. 51). East Lansing: Michigan State University, Institute for Research on Teaching, $5.50. **(Also published in S. Paris. G. Olson, & H. Stevenson (Eds.), *Learning and motivation in the classroom*. Hillsdale, NJ: Erlbaum, 1983.)**

Brophy. J. E. (1982). *Research on the self-fulfilling prophecy and teacher expectations. (Research Series No. 119).* East Lansing: Michigan State University, Institute for Research on Teaching, $8.00. **(Also published in *Journal of Educational Psychology*, 1982, *75*, 631-661.)**

Brophy. J. E. (1980). *Teacher praise: A functional analysis* (Occasional Paper No. 28). East Lansing: Michigan State University, Institute for Research on Teaching, $5.00. **(Also published in *Review of Educational Research*, 1981, *51*, 5-32.)**

Brophy, J. (1980). *Teachers' cognitive activities and overt behaviors* (Occasional Paper No. 39). East Lansing: Michigan State University, Institute for Research on Teaching. $5.50

Brophy, J. E. (1979). *Teacher behavior and its effects* (Occasional Paper No. 25). East Lansing: Michigan State University, Institute for Research on Teaching, $3.75. **(Also published in *Journal of Educational Psychology*, 1979, *71*, 733-750.)**

Brophy, J. E. (1979). *Using observation to improve your teaching* (Occasional Paper No. 21). East Lansing: Michigan State University, Institute for Research on Teaching, $1.50. **(Also published in *Childhood Education*, 1979, 55, 313-317.)**

Brophy, J., & Good, T. (1984). *Teacher behavior and student achievement* (Occasional Paper No. 73). East Lansing: Michigan State University, Institute for Research on Teaching, $16.00. **(Also published in M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 328-375). New York: Macmillan, 1986.)**

Brophy, J. E., & Hannon, P. (1984). *The future of microcomputers in the classroom* (Occasional Paper No. 76). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Brophy, J., & Kher, N. (1986). *Teacher socialization as a mechanism for developing student motivation to learn* (Research Series No. 157). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Brophy, J. E., & Putnam, J. G. (1978). *Classroom management in the elementary grades* (Research Series No. 32). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. **(Also published in D. Duke (Ed.), *Classroom management* (the 78th yearbook of the National Society for the Study of Education, part III). Chicago: University of Chicago Press, 1979.)**

Brophy, J. E., & Rohrkemper, M. M. (1982). *Motivational factors in teachers' handling of problem students* (Research Series No. 110). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Brophy, J. E., & Rohrkemper M. M. (1980). *The influence of problem ownership on teachers' perceptions of and strategies for coping with problem students* (Research Series No. 84). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published in *Journal of Educational Psychology*, 1981, *73*, 295-311).**

Brophy, J. E., & Rohrkemper, M. M. (1980). *Teachers' specific strategies for dealing with hostile, aggressive students* (Research Series No. 86). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Brophy, J., Rohrkemper, M., Rashid, H., & Goldberger, M. (1982). *Relationships between teachers' presentations of classroom tasks and students' engagement in those tasks* (Research Series No. 116). East Lansing: Michigan State University, Institute for Research on Teaching, $2.50. **(Also published in *Journal of Educational Psychology*, 1983, *75*, 544-552)**

Medick, J. (1979). *Effective classroom strategies for three problem behaviors: Hostile-aggressive, passive-aggressive, and withdrawn failure-image* (Occasional Paper No. 30). East Lansing: Michigan State University, Institute for Research on Teaching. $8.75

Rohrkemper, M. M. (1984). *Individual differences in students' perceptions of routine classroom events* (Research Series No. 144). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Rohrkemper, M. M., & Brophy, J. E. (1980). *Teachers' general strategies for dealing with problem students* (Research Series No. 87). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Articles Available Only in Journals and Other Periodicals

Brophy, J.(1986). Classroom management techniques. *Education and Urban Society, 18*, 182-194.

Brophy, J. (1985). Classroom management as instruction: Socializing self-guidance in students (Special issue on teaching self-discipline). *Theory into Practice, 24*, 233-240.

Brophy, J. (1984). Designing curriculum and instruction. Book review of S. Engelmann & D. Carnine, *Theory of instruction: Principle and applications. Contemporary Psychology, 29*, 622-624.

Brophy, J. (1984). A sociological approach to early schooling. Review of D. Entwisle & L. Haydule, *Early schooling: Cognitive and affective outcomes. Contemporary Psychology, 29*, 59-60.

Brophy, J. (1984). This week's Citation Classic (essay on J. Brophy & T. Good's, *Teacher-student relationships: Causes and consequences*). *Current Contents, 16* (20), 16.

Brophy, J. (1983). A useful bibliography. Review of M. Powell & J. Beard (Eds.), *Teacher effectiveness: An annotated bibliography and guide to research. Contemporary Education Review, 2*, 231-232.

Brophy, J. (1982). Book review of C. Denham & A. Lieberman (Eds.), *Time to learn. Contemporary Psychology, 27*, 725-726.

Brophy, J. (1982). Book review of W. Ray Rhine (Ed.), *Making schools more effective: New directions from Follow Through. Contemporary Psychology, 27*, 302-303.

Brophy, J. (1982). Classroom management and learning. *American Education, 18* (2), 20-23.

Brophy, J. (1982). How teachers influence what is taught and learned in classrooms. *Elementary School Journal, 83*, 1-14. **(Summarized in *Educational Digest*, 1983, *48* (5), 24-28.)**

Brophy, J. (1982). Schooling as students experience it. *Elementary School Journal, 82*, 519-529.

Brophy, J. (1982). Successful teaching strategies for the inner-city child. *Phi Delta Kappan, 63*, 527-530. **(Reprinted in K. Ryan & J. Cooper (Eds.), *Kaleidoscope: Reading in education*. Boston: Houghton Mifflin, 1984.)**

Brophy, J. (1981). On praising effectively. *Elementary School Journal, 81*, 269-278.

Brophy, J. (1981). Recent research on teaching. *The Researcher, 19* (1), 8-24.

Brophy, J. (1980). Book review of I. Hyman, & J. Wise (Eds.), *Corporal punishment in American education: Readings in history, practice, and alternatives. Contemporary Psychology, 25*, 485-486.

Brophy, J. (1979). Advances in teacher effectiveness research. *Journal of Classroom Interaction, 15*, 1-7.

Brophy, J. (1979). Teacher behavior and student learning. *Educational Leadership, 37* (1), 33-38.

Gross, S. (1986, March). Getting away from the daily grind. *Michigan School Board Journal*, pp, 10-11.

Rohrkemper, M. M. (1984). The influence of teacher socialization style on students' social cognition and reported interpersonal classroom behavior. *Elementary School Journal, 85*, 254-275.

Books and Chapters in Books

Brophy, J. (1985). Teachers' expectations, motives, and goals for working with problem students. In C. Ames & R. Ames (Eds.), *Research in motivation in education* (Vol. 2: The classroom milieu, pp. 175-214). Orlando, FL: Academic Press.

Brophy, J. (1984). Research on teaching and teacher education: The interface. In P. Grimmett (Ed.), *Research in teacher education: Current problems and future prospects in Canada*. Vancouver: Centre for the Study of Teacher Education, University of British Columbia.

Brophy, J. (1984). Successful strategies for teaching the inner-city child. Reprinted in K. Ryan & J. Cooper (Eds.), *Kaleidoscope: Readings in education*. Boston: Houghton Mifflin.

Brophy, J. (1984). Supplemental group management techniques. In D. Duke (Ed.), *Helping teachers manage classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development.

Brophy, J. (1984). The teacher as thinker: Implementing instruction. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions*. New York: Longman.

Brophy, J. (1978). Interactions between learner characteristics and optimal instruction. In D. Bart-Tal & L. Saxe (Eds.), *Social psychology of education: Theory and research*. Washington, DC: Hemisphere.

Good, T., & Brophy, J. (1984). *Looking in classrooms*, 3rd edition. New York: Harper & Row.

Medick, J. M. (1981). *Classroom Behavior—Turning it around: Strategies of a teacher.* East Lansing, MI: Fanning Press.

Rohrkemper, M., & Brophy, J. (1983). Teachers' thinking about problem students. In J. Levine & M. Wang (Eds.), *Teacher and student perceptions: Implications for learning.* Hillsdale, NJ: Erlbaum.

Conceptual Analytic

As a complement to its empirical work, the IRT initiated this project to evaluate ideas and practices recommended to teachers and teacher educators. The project stresses conceptual analysis—assessing the adequacy and completeness of the rationales underlying recommended practices, identifying hidden assumptions or unrecognized complications, and clarifying important differences between seemingly similar ideas.

IRT Publications

Buchmann, M. (1986). *Reporting and using educational research: Conviction or persuasion?* (Occasional Paper No. 96). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. (To be published in J. I. Goodlad (Ed.), *Ecology of school improvement* (1987 yearbook of the National Society for the Study of Education). Chicago: University of Chicago Press.)

Buchmann, M. (1985). *Improving education by talking: Argument or conversation?* (Occasional Paper No. 66). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. (Published in *Teachers College Record*, 1985 *86*, 441-453.)

Buchmann, M. (1985). *Role over person: Legitimacy and authenticity in teach* (Occasional Paper No. 87). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00. (To be published in M. Ben-Peretz, R. Bromme, & R. Halkes (Eds.), *Advances in Teacher Thinking* (2nd yearbook of the International Study Association on Teacher Thinking) Heerenweg, The Netherlands: Swets; and under the title "Role over person: Morality and authentity in teaching" in *Teachers College Record.)*

Buchmann, M. (1984). *What is irrational about knowledge utilization?* (Occacional Paper No. 57). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25. (Also published in *Curriculum Inquiry*, 1985, *15* (2), 153-168).

Buchmann, M. (1983). *The priority of knowledge and understanding in teaching* (Occasional Paper No. 61). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Buchmann, M. (1983). *Role over person: Justifying teacher action and decisions* (Research Series No. 135). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Buchmann, M. (1983). *The use of research knowledge in teacher education and teaching* (Occasional Paper No. 71). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. (Also published in *American Journal of Education*, 1984, *92*, 421-439.)

Buchmann, M., & Schwille, J. (1982). *Education: The overcoming of experience* (Occasional Paper No. 63). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. (Also published in *American Journal of Education*, 1983, *92*, 30-51).

Feiman-Nemser, S. (1983). *Learning to teach* (Occasional Paper No. 64). East Lansing: Michigan State University, Institute for Research on Teaching, $3.50. (Also published in L. Shulman & G. Sykes (Eds.), *Handbook on teaching and policy*. New York: Longman, 1983.)

Feiman-Nemser, S., & Buchmann, M. (1983). *Pitfalls of experience in teacher preparation* (Occasional Paper No. 65). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. (Also published in *Teachers College Record*, 1985, *87*, 53-65 and to be published in L. Katz & J. Raths (Eds.), *Advances in teacher education* (Vol. 2). Norwood, NJ: Ablex.)

Feiman-Nemser, S. & Floden, R. E. (1984). *The cultures of teaching* (Occasional Paper No. 74). East Lansing: Michigan State University, Institute for Research on Teaching, $8.00. (Also published in M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 505-526. New York: Macmillan, in press.)

Floden, R. E. (1985). *The role of rhetoric in changing teachers' beliefs* (Occasional Paper No. 78). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. (Also published in *Teaching and Teacher Education*, 1985, *1*, 19-32.)

Floden, R. E., & Buchmann, M. (1985). *The trouble with meaningfulness* (Occasional Paper No. 82). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Articles Available Only in Journals and Other Periodicals

Buchmann, M. (1982). The flight away from content in teacher education and teaching. *Journal of Curriculum Studies, 14*, 61-68.

Buchmann, M. (1981). Can traditional lore guide right choice in teaching? *Journal of Curriculum Studies, 13*, 339-348.

Floden, R. E. (1983). A reasonable explanation of assimilation and accommodation. Review of H. G. Petrie, The dilemma of enquiry and learning. *Contemporary Psychology, 28*, 49-50.

Content Determinants

Teachers' decisions about what topics to teach to which children and to what standards of achievement determine, in large part, students' opportunities to learn. Focusing on fourth-grade mathematics, researchers are looking at these and other content decisions and how they are shaped. Possible influences on teachers' content decisions under investigation include state and local school policy, teachers' subject matter knowledge, and student characteristics.

IRT Publications

Floden, R. E., Porter, A. C., Schmidt, W. H., & Freeman, D. J. (1978). *Don't they all measure the same thing? Consequences of selecting standardized tests* (Research Series No. 25). East Lansing: Michigan State University, Institute for Research on Teaching, $1.50. **(Also published in E. L. Baker & E. S. Quellmalz (Eds.), *Educational testing and evaluation: Design, analysis, and policy.* Beverly Hills: Sage, 1980.)**

Floden, R. E., Porter, A. C., Schmidt, W. H., Freeman, D. J., and Schwille, J. R. (1980). *Responses to curriculum pressures: A policy-capturing study of teacher decisions about content* (Research Series No. 74). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published in *Journal of Educational Psychology*, 1981, *73*, 129-141.)**

Freeman, D. J. (1978). *Conceptual issues in the content/strategy distinction* (Research Series No. 21). East Lansing: Michigan State University, Institute for Research on Teaching. $2.25

Freeman, D., Belli, G., Porter, A., Floden, R., Schmidt, W., & Schwille, J. (1983). *Consequences of different styles of textbook use in preparing students for standardized tests* (Research Series No. 107). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published under the title "The influence of different styles of textbook use on the instructional validity of standardized tests" in *Journal of Educational Measurement*, 1983, *20*, 259-270.)**

Freeman, D., Kuhs, T., Knappen, L., & Porter, A. (1979). *A closer look at standardized tests* (Research Series No. 53). East Lansing: Michigan State University, Institute for Research on Teaching, $1.50. **(Also published in *Arithmetic Teacher*, 1982, *29*, 50-54.)**

Freeman, D. J, Kuhs, T. M., Porter, A. C., Knappen, L. B., Floden, R. E., Schmidt, W. H., & Schwille, J. R. (1980). *The fourth-grade mathematics curriculum as inferred from textbooks and tests* (Research Series No. 82). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Kuhs, T. M., & Freeman, D. J. (1979). *The potential influence of textbooks on teachers' selection of content for elementary school mathematics* (Research Series No. 48). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Kuhs, T., Porter, A., Floden, R., Freeman, D., Schmidt, W., & Schwille, J. (1983). *Differences among teachers in their use of curriculum imbedded tests* (Research Series No. 133). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Published in *Elementary School Journal*, 1985, *86*, 141-153.)**

Kuhs, T., Schmidt, W., Porter, A., Floden, R., Freeman, D., & Schwille, J. (1979). *A taxonomy for classifying elementary school mathematics content* (Research Series No. 4). East Lansing: Michigan State University, Institute for Research on Teaching. $2.25

Porter, A. C. (1978). *Relationships between testing and the curriculum* (Occasional paper No. 9). East Lansing: Michigan State University, Institute for Research on Teaching. $1.00

Porter, A. C., Schmidt, W. H., Floden, R. E., & Freeman, D. J. (1978). *Impact on what? The importance of content covered* (Research Series No. 2). East Lansing: Michigan State University, Institute for Research on Teaching, $1.75. **(Also published under the title "Practical significance in program evaluation" in *American Educational Research Journal*, 1978, *15*, 529-539.)**

Porter, A. C., Schwille, J. R., Floden, R. E., Freeman, D. J., Knappen, L. B., Kuhs, T. M., & Schmidt, W. H. (1979). *Teacher autonomy and the control of content taught* (Research Series No. 24). East Lansing: Michigan State University, Institute for Research on Teaching. $3.75

Schmidt, W. H., Porter, A. C., Schwille, J. R., Floden, R. E., & Freeman, D. J. (1982). *Validity as a variable: Can the same certification test be valid for all students?* (Occasional Paper No. 53). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. **(Also published in G. F. Madaus (Ed.), *The courts, validity and minimum competency testing.* Boston, MA: Kluwer-Nijhoff, 1982).**

Schwille, J., Porter, A., Belli, G., Floden, R., Freeman, D., Knappen, L., Kuhs, T. & Schmidt, W. (1982). *Teachers as policy brokers in the content of elementary school mathematics* (Research Series No. 113). East Lansing: Michigan State University, Institute for Research on Teaching, $4.00. **(Also published in L. Shulman & G. Sykes (Eds.), *Handbook of teaching and policy.* New York: Longman, 1983.)**

Schwille, J., Porter, A., Gant, M. (1979). *Content decision making and the politics of education* (Research Series No. 52). East Lansing: Michigan State University, Institute for Research on Teaching, $2.50. **(Also published in *Educational Administration Quarterly*, 16, 21-40, 1980.)**

Schwille, J., Porter, A., Gant, M., Belli, G., Floden, R., Freeman, D., Knappen, L., Kuhs, T., & Schmidt, W. (1979). *Factors influencing teachers' decisions about what to teach: Sociological perspectives* (Research Series No. 62). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50.

Articles Available Only in Journals and Other Periodicals

Alford, L. (1986, February). Should your district have a policy on time allocation? *Michigan School Board Journal*, pp. 12-13.

Freeman, D. J., Kuhs, T. M., Porter, A. C., Floden, R. E., Schmidt, W. H., & Schwille, J. R. (1983). Do textbooks and tests define a national curriculum in elementary school mathematics? *The Elementary School Journal, 83,* 501-513. **(Summarized in *The Education Digest,* 1984, March, 47-49.)**

Porter, A. C. (1983). The role of testing in effective schools. *American Education, 19* (1), 25-28.

Schmidt, W. H. (1983). Content biases in achievement tests. *Journal of Educational Measurement, 20* (2), 165-178.

Books and Chapters in Books

Porter, A. C. (1981). Elementary mathematics textbooks. In J. Y. Cole & T. G. Sticht, *The textbook in American society.* Washington, DC: Library of Congress.

Dilemma Management

Teaching has been characterized as fraught with dilemmas and plagued with internal conflicts impossible to resolve. Much of what has been written assumes that choices between conflicting goals are inevitable. This project investigates how teachers manage such dilemmas and the strategies they use to cope with contradictions.

IRT Publications

Lampert, M. (1986). Knowing, doing, and teaching multiplication (Occasional Paper No. 97). East Lansing: Michigan State University, Institute for Research on Teaching. $5.75. **(To be published under the title "Understanding, doing and teaching multiplication" in *Cognition and Instruction.*)**

Lampert, M. (1985). How do teachers manage to teach? (Occasional Paper No. 33). East Lansing: Michigan State University, Institute for Research on Teaching, $3.50. **(Also published in *Harvard Educational Review,* 1985, 55, 178-194 and reprinted in *Schooling and teaching: New directions and challenges* (pp. 76-92). Cambridge, MA: Harvard Educational Review, 1986.)**

Books and Chapters in Books

Lampert, M. (1986). Teaching about thinking and thinking about teaching. In P. Taylor (Ed.), *Recent developments in curriculum studies.* Windsor, England: NFER-Nelson. (Distributed by Taylor & Francis, Philadelphia).

Effective Schools

What are the differences between schools where scores on student achievement tests are rising and schools where those scores are falling? Researchers working on this project looked at a number of different urban schools and recorded these differences.

IRT Publications

Brookover, W. B., & Lezotte, L. W. (1979). *Changes in school characteristics coincident with changes in student achievement* (Occasional Paper No. 17). East Lansing: Michigan State University, Institute for Research on Teaching, $5.00; executive summary, $1.00.

Edmonds, R. R. (1983). *An overview of school improvement programs* (Occasional paper No. 67). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published in *Educational Leadership,* 1982, *40* (3), 4-11.)**

Lezotte, L. W. (1981). *Effective teacher training and urban school improvement* (Occasional paper No. 49). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Lezotte, L. W., & Passalacqua, J. (1978). *Individual school buildings do account for differences in measured pupil performance* (Occasional Paper No. 6). East Lansing: Michigan State University, Institute for Research on Teaching. $1.25

Articles Available Only in Journals and Other Periodicals

Brandt, R. (1982, Dec.). On school improvement: A conversation with Ronald Edmonds. *Educational Leadership, 40* (3), 12-15.

Brookover, W. B., & Lezotte, L. W. (1981). Educational equity: A democratic principle at a crossroads. *Urban Review, 13,* 65-71.

Lezotte, L. W. (1981). Climate characteristics in instructionally effective schools. *IMPACT on instructionally effective schools, 16* (4).

Lezotte, L., & Passalacqua, J. (1978). Individual school buildings: Accounting for differences in measured pupil performance. *Urban Education, 13,* 283-293.

Books and Chapters in Books

Barletta, C., Boger, R., Lezotte, L. W., & Hall, B. (Eds.). (1978). *Planning and implementing parent/community involvement into the instructional delivery system.* East Lansing: Michigan State University, Teacher Corps Project.

Brookover, W., Beamer, L., Efthim, H., Hathaway, D., Lezotte, L., Miller, S., Passalacqua, J., & Tornatzky, L. (1982). *Creating effective schools.* Holmes Beach, FL: Learning Publications

Lezotte, L. W., Hathaway, D. V., Miller, S. K., Passalacqua, J., & Brookover, W. (1980). *School learning climate and student achievement.* Tallahassee, FL: Site Specific Technical Assistance Center, Florida State University.

General Mathematics

Ninth-grade mathematics is generally unrewarding and unsuccessful for both students and teachers. Researchers, in collaboration with math teachers, designed strategies for improving general mathematics instruction, then helped those teachers implement the strategies in their own classrooms.

IRT Publications

Anang, A., & Lanier, P. (1982). *Where is the subject matter? How the social organization of the classroom affects teaching* (Research Series No. 114). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00

Belli, G. (1979). Survey method and its use in research on general mathematics (Research Series No. 54). East Lansing: Michigan State University, Institute for Research on Teaching. $2.30

Belli, G. (1979). *A survey of placement policies for ninth-grade mathematics* (Research Series No. 61). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Lanier, P. E. (1981). *Mathematics classroom inquiry: The need, a method, and the promise* (Research series No. 101). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Madsen-Nason, A., & Lanier, P. E. (1986). *Pamela Kaye's general math class: From a computational to conceptual orientation* (Research Series No. 172). East Lansing: Michigan State University, Institute for Research on Teaching. $11.00

Articles Available Only in Journals and Other Periodicals

Eaton, J. (1985, January). Drill and practice alone won't do for general math. *Michigan School Board Journal*, p. 13.

Lanier, P., & Nason, A. (1986, Winter). The guest room. *Virginia Mathematics Teacher*, pp. 1-11.

Prawat, R. S., Lanier, P. E., Byers, J. L., & Anderson, A. L. H. (1983). Attitudinal differences between students in general mathematics and algebra classes. *Journal of Educational Research, 76*, 215-220.

High School Standards

A review of the literature from the past 20 years reveals that an implicit bargain to sacrifice academic content for comfortable classroom social relations has shaped current high school standards. This has implications for educational reform. Researchers conducted a national survey of adults that showed support for more rigorous academic standards but not at the expense of extracurricular activities or vocational, social, or personal development goals. A third phase of this study involves field work in two districts with positive reputations for high school reform.

IRT Publications

Freeman, D. J., Cusick, P. A., & Houang, R. T. (1985). Public response to proposals for raising academic standards in secondary schools. (Research Series No. 163. East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published under the title "Secondary school reform: What does the public say?" *NASSP Bulletin*, 1985, 69, 483, 52-63.)**

Books and Chapters in Books

Sedlak, M. W., Pollin, R., Wheeler, C., & Cusick, P. (1986). *Classroom perspectives on school reform.* New York: Teachers College Press.

Integrating Assessment and Instruction

What should teachers know about student assessment data to use it effectively in their teaching? Researchers have developed materials and procedures for increasing teachers' understanding and use of test scores and other assessment data when making instructional decisions.

IRT Publications

Rudman, H., Kelly, J., Wanous, D., Mehrens, W., Clark, C. & Porter, A. (1980). *Integrating assessment with instruction: A review (1922-1980)* (Research Series No. 75). East Lansing: Michigan State University, Institute for Research on Teaching. $7.50

Articles Available Only in Journals and Other Periodicals

Wanous, D., & Mehrens, W. (1981). Helping teachers use information: *The Data Box* approach. *Measurement in Education*, 1981, *12* (4).

Other

Rudman, H. C., Mehrens, W. A., & Wanous, D. S. (1983). *The Data Box*. Cleveland, OH: The Psychological Corporation.

Knowledge Use in Learning to Teach

By following several students through two years of teacher preparation, researchers working on this project are beginning to understand the kinds of knowledge future teachers value and use and the ways different teacher education programs shape their epistemological commitments.

IRT Publications

Feiman-Nemser, S., & Buchmann, M. (1985). *The first year of teacher preparation: Transition to pedagogical thinking?* (Research Series No. 156). East Lansing: Michigan State University, Institute for Research on Teaching, $3.50. (To be published in *Journal of Curriculum Studies.*)

Language Arts

This project investigated teachers' decisions about language arts teaching—how language arts time is spent in classrooms, what content is being emphasized while language skills are being taught, how teachers combine language arts instruction with instruction in other subjects, and the consequences of that instruction.

IRT Publications

Buchmann, M., & Schmidt, W. H. (1981). *The school day and content commitments* (Research Series No. 83). East Lansing: Michigan State University, Institute for Research on Teaching, $2.75. (Also published in revised form as Schmidt, W. H., & Buchmann, M. (1983). Six teachers' beliefs and attitudes and their curricular time allocations. *Elementary School Journal, 84,* 162-171.)

Roehler, L., Schmidt, W., & Buchmann, M. (1979). *How do teachers spend their language arts time?* (Research Series No. 66). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Schmidt, W. H., Caul, J., Byers, J. L., & Buchmann, M. (1983). *Educational content of basal reading texts: Implications for comprehension instruction* (Researcher Series No. 131). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. (Also published as "Content of basal text selections: Implications for comprehension instruction" in G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions.* New York: Longman, 1984)

Schmidt, W., Roehler, L., Caul, J., Diamond, B., Solomon, D., Cianciolo, P., & Buchmann, M. (1983). *Curriculum integration: Its use in language arts instruction* (Research Series No. 140). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. (Published under the title "The uses of curriculum integration in language arts instruction: A study of six classrooms." *Journal of Curriculum Studies,* 1985, 17, (3), 305-320.)

Clinical Studies/Outcomes in Reading

Researchers here have developed a training program that leads to improved diagnostic reliability in reading. They are currently looking at ways in which having reliable diagnostic information about students can help teachers identify instructional practices that can lead to improved reading achievement.

IRT Publications

Elstein, A. S., Shulman, L. S., Vinsonhaler, J. F., Wagner, C. C., & Bader, L. (1978). *Characteristics of the clinical problem-solving model and its relevance to education research* (Research Series No. 27). East Lansing: Michigan State University, Institute for Research on Teaching. $1.25

Gil, D., & Freeman, D. (1980). *Diagnosis and remediation of reading difficulties in the classroom.* (Research Series No. 78). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Gil, D., Hoffmeyer, E. VanRoekel, J., Vinsonhaler, J., & Weinshank, A. (1979). *Clinical problem solving in reading: Theory and research* (Research Series No. 45). East Lansing: Michigan State University, Institute for Research on Teaching. $3.30

Gil, D., Vinsonhaler, J. F., & Wagner, C. C. (1979). *Studies of clinical problem-solving behavior in reading diagnosis* (Research Series No. 42). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Lee, A., & Weinshank, A. (1978). *CLIPIR pilot observational study of reading diagnosticians, 1976* (Research Series No. 14). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00; with complete data, $5.75

Patriarca, L., VanRoekel, J., & Lezotte, L. (1979). *Simulated reading and learning disability cases: Effective tools for research and teacher education* (Research Series No. 29). East Lansing: Michigan State University, Institute for Research on Teaching. $2.30

Vinsonhaler, J. F., Wagner, C. C., & Elstein, A. S. (1978). *The inquiry theory: An information-processing approach to clinical problem-solving research and application*

(Research Series No. 1). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Vinsonhaler, J. F., Weinshank, A. B., Polin, R. M., & Wagner, C. C. (1983). *Improving diagnostic reliability in reading through training*. (Research Series No. 126). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Vinsonhaler, J. F., Weinshank, A. B., Wagner, C. C., & Polin, R. M. (1982). *Diagnosing children with educational problems: Characteristics of reading and learning disabilities specialists and classroom teachers* (Research Series No. 117). East Lansing: Michigan State University, Institute for Research on Teaching, $5.00. **(Also published in *Reading Research Quarterly*, 1983, *18*, 134-164.)**

Weinshank, A. (1980). *Investigations of the diagnostic reliability of reading specialists, learning disabilities specialists, and classroom teachers: Results and implications* (Research Series No. 88). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Weinshank, A. B. (1980). *An observational study of the relationship between diagnosis and remediation in reading* (Research Series No. 72). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Weinshank, A. B., Polin, R. M., & Wagner, C. C. (1985). Using student diagnostic information to etablish an empirical data base in reading (Research Series No. 162). East Lansing: Michigan State University, Institute for Research on Teaching. $4.50

Weinshank, A., Polin, R., & Wagner, C. (1984). *Learning from experience to improve outcomes in reading: A case study* (Research Series No. 149). East Lansing: Michigan State University, Institute for Research on Teaching. **(Also published in *Reading Horizons*, 1985, *25*, 253-263.)**

Articles Available Only in Journals and Other Periodicals

Frame, R. E., Clarizo, H. F., & Porter, A. C. (1984). Diagnostic and prescriptive bias in school psychologists' reports of a learning disabled child. *Journal of Learning Disabilities, 17*, 12-16.

Weinshank, A. (1982). The reliability of diagnostic and remedial decisions of reading specialists. *Journal of Reading Behavior, 14*, 33-50.

Weinshank, A., & Vinsonhaler, J. (1983). On diagnostic reliability in reading: What's wrong and what can be done? *Topics in Learning and Learning Disabilities, 2* (4), 43-51.

Science Teaching

Many students have profound misconceptions about scientific topics that limit the impact of most science instruction. Researchers are exploring what teachers need to know to overcome such misconceptions and trying to find out whether revised curriculum materials and teacher training can provide teachers with the knowledge they need.

IRT Publications

Anderson, C. W., & Barufaldi, J. P. (1980). *Research on elementary school science teaching: A study using short-term outcome measures* (Occasional Paper No. 37). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Anderson, C. W., Sheldon, T. H., & DuBay, J. (1986). *The effects of instruction on college nonmajors' conceptions of respiration and photosynthesis* (Research Series No. 164). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(To be published in *Journal of Research in Science Teaching*.)**

Anderson, C. W., & Smith, E. L (1986). *Children's conceptions of light and color: Understanding the role of unseen rays* (Research Series No. 166). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Anderson, C. W., & Smith, E. L. (1983). *Transparencies on light: Teacher's manual* (Research Series No. 130). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Bishop, B. A., & Anderson, C. W. (1986). *Evolution by natural selection: A teaching module* (Occasional Paper No. 91). East Lansing: Michigan State University, Institute for Research on Teaching. $5.50

Bishop, B. A., & Anderson, C. W. (1986). *Student conceptions of natural selection and its role in evolution* (Research Series No. 165). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Bishop, B. A., Roth, K. J., Anderson, C. W. (1986). *Respiration and photosynthesis: A teaching module* (Occasional Paper No. 90). East Lansing: Michigan State University, Institute for Research on Teaching. $6.25

Brehm, S., Anderson, C. W., & DuBay, J. (1986). *Ecology: A teaching module* (Occasional Paper No. 94). East Lansing: Michigan State University, Institute for Research on Teaching. $4.50

Eaton, J. F., Anderson, C. W., & Smith, E. L. (1983). *Students' misconceptions interfere with learning: Case studies of fifth-grade students* (Research Series No. 128). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00. **(Also published in *Elementary School Journal*, 1984, *84*, 365-379.)**

Eaton, J., Sheldon, T. H., & Anderson, C. W. (1986). *Light: A teaching module* (Occasional Paper No. 92). East Lansing: Michigan State University, Institute for Research on Teaching. $5.50

Hollon, R. E., & Anderson, C. W. (1986). *Heat and temperature: A teaching module* (Occasional Paper No. 93). East Lansing: Michigan State University, Institute for Research on Teaching. $5.50

Hollon, R., Anderson, C. W., & Smith, E. L. (1981). *An instructional system for observing and analyzing elementary school science teaching: A user's manual* (Research Series No. 90). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Landes, N., Smith, E. L., & Anderson, C. (1981). *The task features analysis system* (Research Series No. 89). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Roth, K. (1985). *Food for plants: Teacher's guide* (Research Series No. 153). East Lansing: Michigan State University, Institute for Research on Teaching. $4.50

Roth, K. J., Anderson, C. W., & Smith, E. L. (1986). *Curriculum materials, teacher talk, and student learning: Case studies in fifth-grade science teaching* (Research Series No. 171). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Slinger, L. A., Anderson, C. W., & Smith, E. L. (1983). *Studying light in the fifth grade: A case study of text-based science teaching* (Research Series No. 129). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Smith, E. L., & Anderson, C. W. (1984). *The Planning and Teaching Intermediate Science Study: Final report* (Research Series No. 147). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Smith, E. L., & Anderson, C. W. (1983). *Plants as producers: A case study of elementary science teaching* (Research Series No. 127). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. (Also published in *Journal of Research in Science Teaching*, 1984, *21*, 685-698.)

Smith, E. L., & Lott, G. W. (1983). *Ways of going wrong in teaching for conceptual change* (Research Series No. 139). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00 (Also published as "Teaching for conceptual change: Ways of going wrong" in H. Helm & J. Novak (Eds.), *Proceedings of the International seminar on student misconceptions in science and mathematics*. Ithaca, NY: Cornell University, 1983.)

Articles Available Only in Journals and Other Periodicals

Eaton, J. (1986, December). New materials can help science instruction. *Michigan School Board Journal*, pp. 8-9.

Eaton, J. F., Anderson, C. W., & Smith, E. L. (1983, April). When students don't *know* they don't know. *Science and Children*.

Books and Chapters in Books

Anderson, C. W., & Smith, E. L. (1984). Children's preconceptions and content area textbooks. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions*. New York: Longman.

Roth, K. J., Smith, E. L., & Anderson, C. W. (1984). Verbal patterns of teachers: Comprehension instruction in the content areas. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions*. New York: Longman.

Smith, E. L., & Sendelbach, N. B. (1982). The programme, the plans and the activities of the classroom: The demands of activity-based science. In J. Olson (Ed.), *Innovation in the science curriculum*. London: Croom Helm.

Secondary School Science

Science teaching suffers from a lack of coordination and leadership. In this project researchers seek to gain an understanding of the factors that influence and limit interaction among middle school and high school science teachers, school administrators, and external agents including university faculty and state education department personnel.

Books and Chapters in Books

Gallagher, J. J. (1986). Teachers as communicators of science and technology. In D. Moore (Ed.), *Communicating science to all: Report of the third US/UK conference on science education*. Hatfield, England: Association for Science Education.

Affective Outcomes/Socialization Outcomes

Here, researchers are trying to find out how effective teachers help students (1) develop individual work habits and assume personal responsibility for their academic performance and (2) learn to function as constructive members of a group and thus develop social responsibility.

IRT Publications

Anderson, A. L., Prawat, R. S., & Anderson, L. M. (1985). *Socialization into the student role: Teacher and student influences* (Research Series No. 160). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Anderson, A., Weiner, B., & Prawat, R. S. (1984). *Affective experience in a classroom* (Research Series No. 150). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Prawat, R. S. (1979). *Teacher perceptions of student affect* (Research Series No. 44). East Lansing: Michigan State

University, Institute for Research on Teaching. $2.50 (Also published in *American Educational Research Journal*, 1980, *17*, 61-73.)

Prawat, R. S., & Solomon, D. J. (1980). *Validation of a classroom climate inventory for use at the early elementary level* (Research Series No. 85). East Lansing: Michigan State University, Institute for Research on Teaching. $1.75 (Also published in *Educational and Psychological Measurement*, 1981, *41*.)

Articles Available Only In Journals and Other Periodicals

Anderson, L. (1985). Book review of R. Ames & C. Ames (Eds.), *Research on motivation in education: Vol 1. Student motivation. Review of Education 11*, 304-305.

Anderson, L., & Prawat, R. (1983). Responsibility in the classroom: A synthesis of research on teaching self-control. *Educational Leadership, 40*, 62-66.

Nickerson, J. R., & Prawat, R. S. (1981). Affective interactions in racially diverse classrooms: A case study. *The Elementary School Journal, 81*, 291-303.

Prawat, R. S. (1985). Affective versus cognitive goal orientations in elementary teachers. *American Educational Research Journal, 22*, 587-604.

Prawat, R. S. (1984). Are we looking for a theory in all the wrong places? *Contemporary Psychology, 29*, 779-780.

Prawat, R. S. (1980). Teacher perceptions of student affect. *American Educational Research Journal, 17*, 61-73.

Prawat, R. S., Byers, J. L., & Anderson, A. H. (1983). An attributional analysis of teachers' affective reactions to student success and failure. *American Educational Research Journal, 20*, 137-142.

Prawat, R. S., & Nickerson, J. N. (1985). The relationshp between teacher thought and action and student affective outcomes. *Elementary School Journal, 85*, 529-540.

Sociocultural Factors

This study focused on the interaction of teachers and students in bilingual Spanish-English classrooms. Researchers looked not only at the language of instruction, but at the culture of instruction—the culturally-based principles for appropriate social interaction and behavior.

Books and Chapters in Books

Cazden, C. B., Maldonado-Guzman, A. A., & Erickson, F. (1980). The contribution of ethnographic research to bicultural bilingual education. In J. E. Alatis (Ed.), *Current issues in bilingual education* (pp. 64-80). Washington, DC: Georgetown University Press.

Student Response Study

Do students really learn much from working independently at their seats? Some students, particularly low achievers, have learned to fill in the blanks without understanding how to actually do their seatwork. Researchers and teachers have developed strategies teachers can use to help all students spend their seatwork time more productively.

IRT Publications

Anderson, L. M. (1981). *Student responses to classroom instruction* (Research Series No. 109). East Lansing: Michigan State University, Institute for Research on Teaching, $2.50. (Also published as "Short-term responses to classroom instruction" in *Elementary School Journal*, 82 96-108.)

Anderson, L. M., Brubaker, N. L., Alleman-Brooks, J., & Duffy, G. G. (1984). *Making seatwork work* (Research Series No. 142). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50; with case studies, $5.75

Articles Available Only In Journals and Other Periodicals

Anderson, L., Brubaker, N. L., Alleman-Brooks, J., & Duffy, G. G. (1985). A qualitative study of seatwork in first-grade classrooms. *Elementary School Journal, 86*, 123-140.

Eaton, J. (1985, May). Research on teaching: Seatwork can be improved. *Michigan School Board Journal*, p. 15.

Eaton, J. (1982, Winter). Do students learn from seatwork? *Noteworthy*, 63-64. (Reprinted from *IRT Communication Quarterly*, Summer 1982. This article was also reprinted, in condensed form, in the March 4, 1983, issue of *Weekly Reader Teacher's Edition* and April/May issue of *Learning*.)

Books and Chapters in Books

Anderson, L. (1985). What are students doing when they do all that seatwork? In C. Fisher & D. Berliner (Eds.), *Perspective on Instructional Time* (pp. 189-202). New York: Longman.

Anderson, L. M. (1984). The environment of instruction: The function of seatwork in a commercially developed curriculum. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions*. New York: Longman.

Teachers' Conceptions of Reading/Teacher Explanation

Does the way teachers explain reading tasks make much difference? Researchers working on this project think it does. They are training teachers to be more explicit in verbally assisting students who are learning to read and are studying the effects of the teachers' instruction on student awareness of the reading process and student achievement.

IRT Publications

Bawden, R., Buike, S., & Duffy, G. (1979). *Teachers' conceptions of reading and their influence on instruction* (Research Series No. 47). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Duffy, G. G. (1983). *From turn taking to sense making: Classroom factors and improved reading achievement* (Occasional Paper No. 59). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published under the title "From turn taking to sense making: Broadening the concept of reading teacher effectiveness." *Journal of Educational Research*, 1983, 76, 134-139).**

Duffy, G. (1981). *Teacher effectiveness research: Implications for the reading profession* (Occasional Paper No. 45). East Lansing: Michigan State University, Institute for Research on Teaching. $4.25 **(Also published as "Teacher effectiveness: Implications for reading education." In M. Kamil (Ed.), *Directions in reading: Research and instruction* (30th yearbook of the National Reading Conference). Rochester, NY: National Reading Conference, 1981.)**

Duffy, G., & Anderson, L. (1982). *Conceptions of Reading Project final report* (Research Series No. 111). East Lansing: Michigan State University, Institute for Research on Teaching. $10.00

Duffy, G. G., & Ball, D. (1983). *Instructional decision making and reading teacher effectiveness* (Occasional Paper No. 69). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Duffy, G. G., & McIntyre, L. D. (1980). *A qualitative analysis of how various primary grade teachers employe the structured learning component of the direct instructional model when teaching reading* (Research Series No. 80). East Lansing: Michigan State University, Institute for Research on Teaching, $3.50. **(Also published as "A naturalistic study of teacher assistance in primary grade reading" in *Elementary School Journal*, 1982, 83, 35-40.)**

Duffy, G. G., & Metheny, W. (1979). *Measuring teachers' beliefs about reading* (Research Series No. 41). East Lansing: Michigan State University, Institute for Research on Teaching, $1.75. **(Also published as "The development of an instrument to measure teacher beliefs about reading" in P. D. Pearson (Ed.), *Reading research: Studies and application* (28th yearbook of the National Reading Conference). Clemson, SC: National Reading conference, 1979.)**

Duffy, G. G., & Putnam, J. (1985). *The subtleties and complexities of instructional explanation in reading: A case study of an expert.* (Research Series No. 155). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Duffy, G., & Roehler, L. (1982). *An analysis of the instruction in reading instructional research* (Occasional Paper No. 52.) East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published in J. Niles & L. Harris (Eds.), *New inquiries in reading: Research and instruction* (31st yearbook of the National Reading Conference). Rochester, NY: National Reading Conference, 1982.)**

Duffy, G. G., Roehler, L. R., & Reinsmoen, D. (1981). *Two styles of direct instruction in teaching second grade reading and language arts: A descriptive study* (Research Series No. 100). East Lansing: Michigan State University, Institute for Research on Teaching. $4.25

Herman, B. A., Duffy, G. G., & Roehler, L. R. (1985). *A descriptive study of the effects and characteristics of direct teacher explanation in a clinical setting* (Research Series No. 159). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Metheny, W. (1980). *The influence of grade and pupil ability levels on teachers' conceptions of reading* (Research Series No. 69). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Michelsen, S., LaSovage, J., & Duffy, G. G. (1984). *An exploration of preservice teachers' conceptual change during reading methods instruction* (Research Series No. 146). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Putnam, J. G. (1984). *One exceptional teacher's systematic decision-making model* (Research Series No. 136). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Putnam, J., & Duffy, G. G. (1984). *A descriptive study of the preactive and interactive decision making of an expert classroom teacher* (Research Series No. 148). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published in J. Niles (Ed.), *Changing perspectives in research on reading: Language processing and instruction* (33rd yearbook of the National Reading Conference). Rochester, NY: National Reading Conference, 1984.)**

Roehler, L. R., Duffy, G. G., Book, C., Meloth, M. S., Vavrus, L. G., Putnam, J., & Wesselman, R. (1985). *Teacher explanation during reading instruction: A technical report of the 1982-1983 study* (Research Series No. 158). East Lansing: Michigan State University, Institute for Research on Teaching, $12.25. **(To be published under the title "The relationship between explicit verbal explanations during reading skill instruction and student awareness and achievement: A study of reading teacher effects" in *Reading Research Quarterly*.)**

Roehler, L. R., Duffy, G. G., Book, C., & Wesselman, R. (1983). *Direct teacher explanation during reading: A pilot study* (Research Series No. 132). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Roehler, L. R., Wesselman, R., & Putnam, J. (1984). *Training teachers for instructional change in reading: A descriptive study* (Research Series No. 143). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **Also published as "A descriptive study of the process of teacher instructional change in** reading" in J. Niles & L. Harris (Eds.), *Searches for meaning in reading: Language processing and instruction* (32nd yearbook of the National Reading Conference). Rochester, NY: National Reading Conference, 1983.)

Articles Available Only in Journals and Other Periodicals

Duffy, G. (1982). Fighting off the alligators: Implications of research for classroom teachers. *Journal of Reading Behavior, 14,* 357-374.

Duffy, G. (1982). There's more to instructional decision-making in reading than the "empty classroom." *Reading Research Quarterly, 17,* 295-305.

Duffy, G. (1980). Research perspectives: Direct instruction. *Michigan Reading Journal, 13,* 23-25.

Duffy, G. (1979). Research perspectives: Reading comprehension. *Michigan Reading Journal, 12,* 70-79.

Duffy, G. (1979). Research perspectives: Secondary schools and functional literacy. *Michigan Reading Journal, 13,* 72-74.

Duffy, G. (1978). Research perspectives: Time allocation and content coverage. *Michigan Reading Journal, 12,* 79-80.

Duffy, G., & Anderson, L. (1984). Teachers' theoretical orientations and the real classroom. *Reading Psychology, 5,* 97-104.

Duffy, G. G. & McIntyre, L. (1982). A naturalistic study of instructional assistance in primary grade reading. *Elementary School Journal, 83,* 15-23.

Duffy, G., & Roehler L. (1986) Constraints on teacher change. *Journal of Teacher Education, 37* (1), 55-59.

Duffy, G., & Roehler, L. (1986). The subtleties of instructional mediation. *Educational Leadership, 43* (7), 23-27.

Duffy, G. G., & Roehler, L. R. (1984). Book review of R. C. Anderson, *Learning to read in American schools: Basal readers and content texts. Journal of Reading Behavior, 16,* 323-328.

Duffy, G., & Roehler, L. (1982). Direct instruction of comprehension: What does it really mean? *Reading Horizons, 23,* 35-40.

Duffy, G., & Roehler, L. (1982). The illusion of instruction. *Reading Research Quarterly, 17,* 438-445.

Duffy, G., & Roehler, L. (1982). Instruction as sense-making: Implications for teacher education. *Action in Teacher Education, 4* (1), 1-7.

Roehler, L., & Duffy, G. (1982). Matching direct instruction to reading outcomes. *Language Arts, 59,* 476-481.

Roehler, L., & Duffy, G. (1981). Classroom teaching is more than opportunity to learn. *Journal of Teacher Education, 32* (3), 7-13.

Books and Chapters in Books

Duffy, G. (1985). Models of reading have direct implications for reading instruction: The negative position. In J. N. Niles & R. Lalik (Eds.), *Issues in literacy: A research perspective* (34th yearbook of the National Reading Conference, pp. 398-401). Rochester, NY: National Reading Conference.

Duffy, G. (1983). Context variables in reading teacher effectiveness In J. Niles & L. Harris (Eds.), *Searches for meaning in reading: Language processing and instruction* (32nd yearbook of the National Reading Conference). Rochester, NY: National Reading Conference.

Duffy, G. (1983). A mere beginning. In L. Gentile & M. Kamil (Eds.), *Reading research revisited.* Columbus, OH: Charles Merrill.

Duffy, G. (1983). Qualitative research and the improvement of instructional practice in reading. In G. McNinch (Ed.), *Reading research to reading practice* (3rd yearbook of the American Reading Forum). Athens: University of Georgia, American Reading Forum.

Duffy, G. (1983). Should we adapt to them or them to us? Messages from research on teaching regarding the reading research to reading practice issue. In G. McNinch (Ed.), *Reading research to reading practice* (3rd yearbook of the American Reading Forum). Athens: University of Georgia, American Reading Forum.

Duffy, G. (1982, April). Making basic skills choices: Values and constraints. In L. Reed & S. Ward (Eds.), *Basic skills issues and choices (pp. 149-156).* St. Louis: CEMREL.

Duffy, G., & Ball, D. (1986). Instructional decision making and reading teacher effectiveness. In J. Hoffman (Ed.), *Effective teaching of reading: Research and practice* (pp. 163-180). Newark, DE: International Reading Association.

Duffy, G., Book, C., & Roehler, L. (1983). A study of direct teacher explanation during reading instruction. In J. Niles & L. Harris (Eds.), *Searches for meanings in reading: Language processing and instruction* (32nd yearbook of the National Reading Conference), pp. 259-303. Rochester, NY: National Reading Conference.

Duffy, G., & Metheny, W. (1979). The development of an instrument to measure teacher beliefs about reading. In P.D. Pearson (Ed.), *Reading research: Studies and application* (28th Yearbook of the National Reading Conference). Clemson, SC: National Reading Conference.

Duffy, G., Roehler, L., & Mason, J. (1984). The reality and potential of comprehension instruction. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions, (pp. 3-9).* New York: Longman.

Duffy, G. & Roehler, L. (1986). *Improving classroom reading instruction: A decision making approach.* New York: Random House.

Duffy, G., Roehler, L., Book, C., & Meloth, M., (1984). The effect and distinguishing characteristics of explicit teacher explanation during reading instruction. In J. Niles (Ed.), *Changing perspectives in research in reading: Language processing and instruction* (33rd yearbook of the National Reading Conference, pp. 213-229.) Rochester, NY: National Reading Conference.

Duffy, G., Roehler, L., & Mason, J. (Eds.). (1984). *Comprehension instruction: Suggestions and perspectives.* New York: Longman.

Duffy, G., Roehler, L., & Wesselman, R. (1985). Disentangling the complexities of instructional effectiveness: A line of research on classroom instruction. In J. N. Niles & R. Lalik

(Eds.), *Issues in literacy: A research perspective* (34th yearbook of the National Reading Conference, pp. 244-250). Rochester, NY: National Reading Conference.

Mason, J., Roehler, L., & Duffy, G. (1984). A practitioner's model of comprehension instruction. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions*. New York: Longman.

Michelson, S., Duffy, G., & LaSovage, J. (1984). An exploration of preservice teachers' conceptual change during reading instruction. In G. McNinch (Ed.), *Reading teacher education* (fourth yearbook of the American Reading Forum). Athens: University of Georgia, American Reading Forum.

Roehler, L., & Duffy, G. (1986). Studying qualitative dimensions of instructional effectivenss. In J. Hoffman (Ed.), *Effective teaching of reading: Research and practice* (pp. 181-198). Newark, DE: International Reading Association.

Roehler, L., & Duffy, G. (1984). Direct explanation of comprehension processes. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Suggestions and perspectives*. (pp. 265-280). New York: Longman.

Roehler, L., Duffy, G., & Meloth, M. (1986). What to be direct about in direct instruction in reading: Content-only over process-into-content. In T. E. Raphael (Ed.), *The contexts of school-based literacy* (pp. 79-95). New York: Random House.

Roehler, L., Wesselman, R., & Putnam, J. (1983). A descriptive study of the process of teacher instructional change in reading. In J. Niles & L. Harris (Eds.), *Searches for meanings in reading: Language processing and instruction* (32nd yearbook of the National Reading Conference), pp. 329-334. Rochester, NY: National Reading Conference.

Roehler, L., Wesselman, R., & Putnam, J. (1983). The process of teacher instructional change. In J. Niles & L. Harris (Eds.), *Searches for meanings in reading: Language processing and instruction* (32nd yearbook of the National Reading Conference). Rochester, NY: National Reading Conference.

Other

Duffy, G., & Roehler, L. (1982). *Building reading skills, levels 1-4* (with accompanying workbooks). Evanston, IL: McDougal, Littell, and Co. (Commercial reading program designed for use at middle school level. Incorporates various elements of instructional research.)

Teacher Planning

Planning is an important aspect of teaching that occurs in the empty classroom or at home on weekends. This project looked at the process of teacher planning and the relationship between planning and actual instruction.

IRT Publications

Clark, C. M. (1983). *Research on teacher planning: An inventory of the knowledge base* (Occasional Paper No. 66). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Clark, C., & Elmore, J. (1981). *Transforming curriculum in mathematics, science, and writing: A case study of teacher yearly planning* (Research Series No. 99). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Clark, C. M., & Elmore, J. L. (1979). *Teacher planning in the first weeks of school* (Research Series No. 56). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Clark, C. M., & Peterson, P. L. (1984). *Teachers' thought processes* (Occasional Paper No. 72). East Lansing: Michigan State University, Institute for Research on Teaching, $13.00. **(Also published in M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 255-296.) New York: Macmillan, 1986.)**

Clark, C. M., & Yinger, R. J. (1980). *The hidden world of teaching: Implications of research on teacher planning* (Research Series No. 77). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Clark, C., & Yinger, R. (1979). *Three studies of teacher planning* (Research Series No. 55). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Clark, C. M., Yinger, R. J., & Wildfong, S. C. (1978). *Identifying cues for use in studies of teacher judgment* (Research Series No. 23). East Lansing: Michigan State University, Institute for Research on Teaching. $1.75

Yinger, R. J. (1978). *A study of teacher planning: Description and a model of preactive decision making* (Research Series No. 18). East Lansing: Michigan State University, Institute for Research on Teaching. $4.25

Yinger, R. J., & Clark, C. M. (1983). *Self reports of teacher judgment* (Research Series No. 134). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Yinger, R. J., & Clark, C. M. (1982). *Understanding teachers' judgments about instruction: The task, the method, and the meaning* (Research Series No. 121). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Yinger, R. J., Clark, C. M., & Mondol, M. M. (1981). *Selecting instructional activities: A policy-capturing analysis* (Research Series No. 103). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Articles Available Only in Journals and Other Periodicals

Clark, C. M. (1979). Choice of a model for research on teacher thinking. *Journal of Curriculum studies, 11,* (ED 166-135)

Clark, C. M. (1979). A new question for research on teaching. *Educational Research Quarterly, 3* (4), 53-58.

Clark, C. M. (1979). Teacher skills, strategies, and styles. *Journal of Teacher Education and Special Education, 2* (2), 35-37.

Clark, C. M., Gage, N. L., Marx, R. W., Peterson, P. L., Stayrook, N. G., & Winne, P.H. (1979). A factorial experiment on teacher structuring, soliciting, and reading. *Journal of Educational Pyschology, 71,* 534-552.

Clark, C. M., & Yinger, R. J. (1979). Research on teacher planning: A progress report. *Journal of Curriculum Studies, 11,* 175-177.

Books and Chapters in Books

Clark, C. M. (1984). Teacher planning and reading comprehension. In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions.* New York: Longman.

Clark, C. M., & Yinger, R. J. (1977). Research on teacher thinking. In P. L. Peterson & H. J. Walberg (Eds.), *Research on teaching.* Berkeley: McCutchan. (Also published in *Curriculum Inquiry, 7* (4), 1979, 279-304.)

Other

Clark, C. M. & Brady, J. (1980). *Teacher decision making and instructional practice* (Report MES-79-IC.2). San Francisco: Far West Laboratory for Educational Research and Development.

Teacher Role and Development

Researchers here examined various dimensions and conceptions of teacher development and how these are influenced by certain professional development activities. They also analyzed the criteria of teaching effectiveness implicit in different approaches to teacher development.

IRT Publications

Feiman, S., & Floden, R. E. (1981). *A consumer's guide to teacher development* (Research Series No. 94). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(Also published in *Journal of Staff Development*, 1980, 126-147.)**

Feiman, S., & Floden, R. (1980). *What's all this talk about teacher development?* (Research Series No. 70). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Floden, R. E., & Feiman, S. (1981). *A developmental approach to the study of teacher change: What's to be gained?* (Research Series No. 93). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Floden, R. E., & Feiman, S. (1981). *Problems of equity in developmental approaches* (Research Series No. 91). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Floden, R. E., & Feiman, S. (1981). *Should teachers be taught to be rational?* (Research Series No. 95). East Lansing: Michigan State University, Institute for Research on Teaching, $2.50. **(Also published in *Journal of Education for Teaching*, 1981, 7, 274-283.)**

Articles Available Only in Journals and Other Periodicals

Feiman, S. (1981). Exploring connections between different kinds of educational research and different conceptions of inservice education. *Journal of Research and Development in Education, 14* (2), 11-21.

Feiman, S., & Floden, R. (1981). Critique of developmental approaches in teacher education. *Action in Teacher Education, 3* (1), 35-38.

Other

Feiman, S. (1980). Growth reflection as aims in teacher education: Directions for research. In *Exploring issues in teacher educaton: Questions for future research.* Austin, TX: Research and Development for Teacher Education, University of Texas, 133-152.

Teachers' Practical Ways of Seeing/Teachers' Conceptual Change in Practice

The first study contrasts the ways experienced teachers see what goes on in classrooms with that of more experienced teachers to see how teachers make sense of events. In the second study three teachers and their principal are working with researchers on ways in which time to reflect critically on their own practice can empower teachers to change their instructional practices and increase their input into educational reform decisions.

IRT Publications

Erickson, F. (1986). *Tasks in times: Objects of study in a natural history of teaching* (Occasional Paper No. 95). East Lansing: Michigan State University, Institute for Research on Teaching, $3.25. **(Published in K. K. Zumwalt (Ed.), *1986 yearbook of the Association for Supervision and Curriculum Development* (pp. 131-147). Washington, DC: ASCD, 1986.)**

Erickson, F., Boersma, D. S., Pelissier, C., & Lazarus, B. B. (1986). *Toward a theory of student status as socially constructed* (Occasional Paper No. 88). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Improving Reading and Writing/Teaching Expository Reading and Writing

One reason why many students have trouble reading and writing informational text may be a lack of understanding of how such texts are organized. Researchers are working with upper elementary teachers to show them how to teach students text structures and to use this knowledge during prewriting, drafting, and revising of stories and reports. Interactions between authors and audience are emphasized.

IRT Publications

Raphael, T. E., & Kirschner, B. M. (1985). *The effects on instruction in compare/contrast text structure on sixth-grade students' reading comprehension and writing products.* (Research Series No. 161). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Raphael, T. E. (1985). *Research on reading: But what can I do on Monday?* (Occasional Paper No. 89). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Articles Available Only in Journals and Other Periodicals

Raphael, T. E. (1986). Teaching question-answer relationships, revisited. *Reading Teacher, 39,* 516, 522.

Time Allocation

Economists examined the allocation of time to different subjects and different students in schools. They also examined the role that factors like socioeconomic status play in the amount and quality of time students receive.

IRT Publications

Brown, B., & Saks, D. (1979). *Research issues concerning the production and finance of schooling* (Research Series No. 65). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Articles Available Only in Journals and Other Periodicals

Brown, B. (1980). Economic grouping and data disaggregation. *New Directions for Methodology of Social and Behavioral Science, 6,* 31-41.

Brown, B., & Saks, D. M. (1981). The microeconomics of school. In D. Berliner (Ed.), *Review of research in education, (Vol. 9, 217-254). Washington DC: American educational Research Association.*

Books and Chapters in Books

Brown, B. (1980). Production technologies and resource allocations within classrooms and schools. In R. Dreeben & J. A. Thomas (Eds.), *The analysis of educational productivity* (pp. 53-117). Ballenger.

Written Literacy

After conducting a descriptive study of the acquisition of written literacy in school, researchers and teachers set up a forum in which to discuss ways the research could inform practice. They conducted a number of workshops for school staff and are now working on a grounded theory of writing instruction.

IRT Publications

Clark, C. M., & Florio-Ruane, S. (1984). *The Written Literacy Forum: Combining research and practice* (Research Series No. 138). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Clark, C. M., & Florio. S. (1981). *Diary time: The life history of an occasion for writing* (Research Series No. 106). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Clark, C., & Florio, S. with Elmore, J., Martin, J., Maxwell, R., & Metheny, W. (1982). *Understanding writing in school: A descriptive study of writing and its instruction in two classrooms* (Research Series No. 104). East Lansing: Michigan State University, Institute for Research on Teaching. $14.00; executive summary, $2.75

Dunn, S., Florio-Ruane, S., & Clark, C. M. (1984). *The teacher as respondent to the high school writer* (Research Series No. 152). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Florio, S. (1978). *The problem of dead letters: Social perspectives on the teaching of writing* (Research Series No. 34). East Lansing: Michigan State University, Institute for Research on Teaching. $1.50 **(Summarized in Flegg, J. (1981). Children write in classroom community. *Michigan English Teacher, 30* (1), 11-12).**

Florio-Ruane, S., & Dohanich, J. B. (1984). *Communicating research findings: Teacher-researcher deliberations* (Research Series No. 151). East Lansing: Michigan State University, Institute for Research on Teaching, $2.00. **(Published in *Language Arts,* 1985, *61,* 724-730.**

Florio-Ruane, S. & Dunn, S. (1985). *Teaching writing: Some perennial questions and some possible answers* (Occasional Paper No. 85). East Lansing: Michigan State University, Institute for Research on Teaching, $5.50. **(To be published in V. Koehler (Ed.), *The educator's handbook.* New York: Longman.)**

Articles Available Only in Journals and Other Periodicals

Clark, C. M., & Florio, S. (1983). The Written Literacy Forum: Combining research and practice. *Teacher Education Quarterly, 10* (3).

Florio-Ruane S. (1985). Learning about language in classrooms. *The Volta Review, 87,* (5), 47-55.

Florio-Ruane, S. (1983). What's so hard about writing? The issues for teachers and students. *Elementary School Journal, 84,* 93-99.

Florio, S., & Clark, C. M. (1982). The functions of writing in an elementary classroom. *Research in the Teaching of English, 16,* 115-130.

Books and Chapters in Books

Clark, C. M., & Florio, S. (1982). Understanding writing in school: Issues of theory and method. In P. Mosenthal & S. Walmsley (Eds.), *Methodological approaches to writing research.* New York: Longman.

Dunn, S., Florio-Ruane, S., & Clark, C. M. (1985). The teacher as respondent to the high school writer. In S. W. Freedman (Ed.), *The acquisition of knowledge: Response and revision* (pp. 33-50). Norwood, NJ: Ablex.

Florio, S., & Clark, C. M. (1982). What is writing for?: Writing in the first weeks of school in a second/third grade classroom. In L. Cherry-Wilkinson (Ed.), *Communicating in the classroom.* New York: Academic Press.

Florio, S. & Clark, C. M. with Elmore, J., Martin, J., Maxwell, R. J., & Metheny, W. (1984). *The classroom as an environment for literacy.* In G. Duffy, L. Roehler, & J. Mason (Eds.), *Comprehension instruction: Perspectives and suggestions.* New York: Longman.

Other Research

IRT Publications

Allington, R. L. (1980). *Poor readers don't get to read much* (Occasional Paper No. 31). East Lansing: Michigan State University, Institute for Research on Teaching. $1.75

Anang, A. J. (1982). *What is reading? A social theory of comprehension instruction* (Occasional Paper No. 62). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Anang, A., & Florio-Ruane, S. (1985). *What's so hard about staff development? A study in face-to-face interaction* (Occasional Paper No. 14). Oxford, OH: National Staff Development Council.

Anderson, C. W. (1982). *The use of codified knowledge in five teacher education programs: A comparative analysis* (Research Series No. 118). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Bennett, N. (1981). *Time to teach: Teaching-learning processes in primary schools* (Occasional Paper No. 43). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Byers, J. L., & Evans, T. E. (1980). *Children's reading interests: A study of teacher judgment* (Research Series No. 81). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Byers, J. L., & Evans, T. E. (1980). *Using a lens-model analysis to identify the factors in teacher judgment* (Research Series No. 73). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Clark, C. M. (1984). *Research on teaching and the content of teacher education programs: An optimistic view* (Occasional Paper No. 75). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Clark, C. M. (1979). *Five faces of research on teaching* (Occasional Paper No. 24). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00 **(Also published in *Educational Leadership*, 1979, 37, 29-32.)**

Clark, C. M. (1978). *Choice of a model for research on teacher thinking* (Research Series No. 20). East Lansing: Michigan State University, Institute for Research on Teaching. $1.50

Clark, C. M., & Lampert, M. (1985). *What knowledge is of most worth to teachers? Insights from studies of teacher thinking* (Occasional Paper No. 86). East Lansing: Michigan State University, Institute for Research on Teaching, $3.00. **(To be published under the title "What knowledge about teaching is useful to teachers." In Marcel Crahay (Ed.), *Teaching and teacher education.* Paris: Nathan Labor.)**

Cusick, P. A. (1978). *Report of a seminar on field research methods in education* (Conference Series No. 2). East Lansing: Michigan State University, Institute for Research on Teaching. $1.50

Cusick, P. (1982). *A study of networks among professional staffs in secondary schools* (Research Series No. 112). East Lansing: Michigan State University, Institute for Research on Teaching. $3.50

Duffy, G. G. (1981). *Theory to practice: How does it work in real classrooms?* (Research Series No. 98). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Eaker, R. E., & Huffman, J. O. (1981). *Helping teachers use research findings: The consumer validation process* (Occasional Paper No. 44). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Eaker, R. E., & Huffman, J. O. (1981). *Teacher perceptions of dissemination of research on teaching findings* (Occasional Paper No. 41). East Lansing: Michigan State University, Institute for Research on Teaching. $5.00

Erickson, F. (1986). *Qualitative methods in research on teaching* (Occasional Paper No. 81). East Lansing: Michigan State University, Institute for Research on Teaching, $14.50. **(Also in M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 119-161). New York: Macmillan, 1986.)**

Erickson, F. (1979). *Mere ethnography: Some problems in its use in educational practice* (Occasional Paper No. 15). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00 **(Also published in *Anthropology and Education quarterly*, 1979, 10, 182-188.)**

Erickson, F. (1979). *On standards of descriptive validity in studies of classroom activity* (Occasional Paper No. 16). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Erickson, F. (1979). *Patterns of sophistication and naivety: Some features of anthropological approaches to the study of education* (Occasional Paper No. 22). East Lansing: Michigan State University, Institute for Research on Teaching. $2.60. **(Also published in H. D. Gideonse, R. Koff, & J. J. Schwab (Eds.), *Values inquiry, and education* (CSE monograph series in evaluation, 9). Los Angeles: University of California, Center for the Study of Evaluation, 1980.)**

Erickson, F., Florio, S., & Buschman, J. (1980). *Fieldwork in educational research* (Occasional Paper No. 36). East Lansing: Michigan State University, Institute for Research on Teaching. $1.50

Erickson, F., & Wilson, J. (1983). *Sights and sounds of life in schools: A resource guide to film and videotape for research and education* (Research Series No. 125). East Lansing: Michigan State University, Institute for Research on Teaching. $6.00

Evans, T. E., & Byers, J. L. (1979). *Teacher judgment of children's reading preferences* (Research Series No. 38). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Floden, R. E. (1978). *Flexner, accreditation, and evaluation* (Research Series No. 5). East Lansing: Michigan State University, Institute for Research on Teaching, $1.75. **(Also published in *Educational Evaluation and Policy Analysis*, 1980, *2*, 35-46. Reprinted in G. G. Madaus, M. Scriven, & D. L. Stufflebeam (Eds.), *Evaluation models: Viewpoints on an educational and human services evaluation*. Boston, Kluwer-Nijoff, 1983.)**

Florio, S. (1981). *Very special natives: The evolving role of teachers as informants in educational ethnography* (Occasional Paper No. 42). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Florio, S. & Walsh, M. (1978). *The teacher as colleague in classroom research* (Occasional Paper No. 4). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Goldberger, M. (1980). *The effects of teaching styles on motor performance, self-concept, and social skill development* (Occasional Paper No. 34). East Lansing: Michigan State University, Institute for Research on Teaching. $2.75

Good, T. L., & Brophy, J. E. (1985). *School effects* (Occasional Paper No. 77). East Lansing: Michigan State University, Institute for Research on Teaching, $11.00. **(Also published in M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 570-602), New York: Macmillan, 1986.)**

Ignatovich, F. R., Cusick, P. A., & Ray, J. E. (1979). *Value/belief patterns of teachers and those administrators engaged in attempts to influence teaching* (Research Series No. 43). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

IRT. (1976). *Current directions in research on teaching: A meeting of the Invisible College of Researchers on Teaching, November 17-19, 1976* (Conference Series No. 1). East Lansing: Michigan State University, Institute for Research on Teaching. $4.25

IRT. (1978). *Proceedings of the Research-on-Teaching Mathematics Conference, May 1-4, 1977* (Conference Series No. 3). East Lansing: Michigan State University, Institute for Research on Teaching. $8.25

Janesick, V. J. (1978). *An ethnographic study of a teacher's classroom perspective: Implications for curriculum* (Research Series No. 33). East Lansing: Michigan State University, Institute for Research on Teaching. $2.25

Joyce, B. (1980). *Toward a theory of information processing in teaching* (Research Series No. 76). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Joyce, B., & McNair, K. (1979). *Teaching styles at South Bay School: The South Bay Study, Part I* (Research Series No. 57). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Lanier, J. (1984). *The future of teacher education: Two papers* (Occasional Paper No. 79). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Lanier, J. E. (1984). *Research on teacher education* (Occasional Paper No. 80). East Lansing: Michigan State University, Institute for Research on Teaching, $14.50. **(Also published in M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp 527-569.) New York: Macmillan.)**

Lanier, J. E. (1978). *Research on teaching: A dynamic area of inquiry* (Occasional Paper No. 7). East Lansing: Michigan State University, Institute for Research on Teaching. $1.25

Lanier, J. E. & Floden, R. E. (1978). *Research and development needs for the advancement of teacher education* (Research Series No. 8). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Lezotte, L. W. (1980). *How can evaluation of staff development centers be made useful to researchers?* (Occasional Paper No. 32). East Lansing: Michigan State University, Institute for Research on Teaching. $1.50

Martin, J. M. (1983). *Approaches to research on teaching: Implications for curricular theory and practice* (Occasional Paper No. 60). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

Martin, J. M. (1983). *Curriculum as transmitter of socioeconomic values: Case study of a middle school writing project* (Occasional Paper No. 56). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

McNair, K., & Joyce, B. (1979). *Teachers' thoughts while teaching: The South Bay Study, Part II* (Research Series No. 58). East Lansing: Michigan State University, Institute for Research on Teaching. $2.50

Morine-Dershimer, G. (1979). *Teacher plan and classroom reality: The South Bay Study, Part IV* (Research Series No. 60). East Lansing: Michigan State University, Institute for Research on Teaching. $4.50

Morine-Dershimer, G. (1979). *Teachers' conceptions of pupils: The South Bay Study, Part III* (Research Series No. 59). East Lansing: Michigan State University, Institute for Research on Teaching. $4.50

Patriarca, L., & Buchmann, M. (1983). *Conceptual development and curriculum change: Or is it rhetoric and fantasy?* (Research Series No. 123). East Lansing: Michigan State University, Institute for Research on Teaching. $3.25

Pernell, E. (1982). *A bibliography for teachers of the behaviorally disordered* (Occasional Paper No. 55). East Lansing: Michigan State University, Institute for Research on Teaching. $2.00

Putnam, J. G. (1984). *Developing an elementary-school, learning-community classroom* (Research Series No. 145). East Lansing: Michigan State University, Institute for Research on Teaching. $4.00

Putnam, J. G., & Barnes, H. (1985). *Application of classroom management research findings* (Research Series No. 154). East Lansing: Michigan State University, Institute for Research on Teaching. $3.00

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